The Chemical Age

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High Pressures in Industry

PERHAPS one of the outstanding impressions that any visitor must have carried away from the recent Chemical Engineering Congress was that chemical engineers the world over are convinced that the future of chemical industry lies in the performance of reactions and processes at ever-increasing pressures. If any confirmation were needed, the altogether fascinating account that Sir Gilbert Morgan gave of the chemical transformations now being carried out by the use of high pressures at Teddington would be ample. These pressure are supported by an outer casing, not at high remarkable in themselves, but are simply a more convenient way of obtaining cheaply substances that could otherwise only be made expensively or of increasing the yield of substances that would otherwise be obtained in amounts so small as to be of doubtful commercial value. Since the days when Haber and Bosch first introduced high-pressure work into Germany, the practice has travelled from the extraordinary to the commonplace and already there are chemists asking for apparatus that can work at 10,000 atmospheres and at temperatures of 300° C.

It becomes almost wholly a matter of design—of chemical engineering. It is necessary to provide reaction vessels, pipe-lines, valves and other auxiliary equipment capable of withstanding high stresses and of offering resistance to corrosion and chemical attack under particularly severe conditions. Owing to cost, high-grade alloy steels and the like can seldom be employed throughout a plant—nor are they always applicable. The design of hydrogenation convertors is an instance in which the stresses due to internal pressure are supported by an outer casing not at high temperature and constructed of steel, whilst the reaction takes place in an inner vessel of thinner walls, but constructed of an expensive alloy. On the other hand, there may be circumstances in which this device is inapplicable and the walls of the vessel have to support the full working pressure and the full working temperatures.

In the oil industry corrosion may be troublesome, and R. K. Hopkins has described in his Chemical Engineering Congress paper methods used for corrosion prevention. Metal-spraying and chromium plating have not been found successful and refractory linings require frequent renewal. Bi-metallic plates in which the base is mild steel and the facing metal a chrome or nichrome steel have been tried, but there seems to be trouble in making these plates of large area and suitable thickness. The most satisfactory results have been obtained by the use of separate linings of 18-8 chromium-nickel steel or 12-14 per cent. chromium steel, approximately 5/64 in. thick, spot-welded to a base metal.

High-pressure vessels in this country are generally solid forged or hollow forged and the question was asked at the Congress whether these could not be built up from sheets and welded together. As instance was given of a vessel 11 ft. by 6 ft. by 3 in. thickness of plate successfully constructed in this way for a working pressure of 60 atmospheres and 320° C., but it was generally agreed that there is difficulty owing to the porosity of the welds when pressures are used over some 200 to 300 atmospheres. This trouble appears to be due to minute pores not revealed by X-ray testing and up to the present there seems to be no evidence that any means of overcoming the difficulty is known. Corrosion is one of the greatest difficulties in many pressure phenomena, particularly because the increased pressure causes increased concentration of the corrosive substances and thus intensifies the reaction. There is, of course, the weakening of the metal due to removal of carbon by hydrogen, if that gas be present. An interesting observation is to the effect that corrosion at welds seems to start from the spot welds, and if no spot welds are employed in welding preferential corrosion at the weld can be avoided. Another valuable recommendation made at the Congress, we believe, by Mr. Colbeck, of Imperial Chemical Industries, was that the strength of materials should always be tested in the transverse direction. This value is, of course, always less than the longitudinal strength, but no doubt that is the reason why transverse strength is the more important.

There are operations in the chemical industry that are conducted under high vacua and one paper before the Congress dealt with the physics of high vacuum technology. It was pertinently mentioned that whereas the physicist desired to study space in which matter was absent, the chemist was not interested unless matter were present. It was therefore very necessary that the chemical industry should decide exactly what was the degree of vacuum necessary for each reaction. It is an interesting speculation whether physical operations on chemical substances could in some instances be conducted with greater effect if the vacua were more perfect. It is desirable to call attention to an apparent divergence of opinion on this question of pressure vessels between the chemical engineer and the metallurgist. The chemical engineer not once but repeatedly during the conference asked that the metallurgist should produce better steels to withstand higher pressures and temperatures. The metallurgist replied in

effect that the problem was primarily one of reducing corrosion, but that from the point of view of pressure existing steels were ample—provided that the chemical engineers would find a suitable design. The construction of hydrogenation convertors has proved an instance in which this has been done, and evidently neither engineer nor metallurgist has reached the limit of advance.

Notes and Comments

The Liverpool Meeting

THREE features that made last week's annual meeting of the Society of Chemical Industry at Liverpool stand out above the average were the exceptional popularity of "Billy" Calder as president, the remarkable Messel Medal lecture in which Sir Robert Mond recounted the growth of the heavy chemical industry as he had seen it himself, and the unusually large attendance of overseas visitors, due, of course, to the fact that many of those who came to London for last month's Chemical Engineering Congress stayed behind for the Liverpool meeting. It was a charming idea on the part of the Liverpool section to mark the close of Mr. Calder's year of office by presenting him with a gilt replica of the presidential badge, especially as, so far as we are aware, the idea of such a gift was quite novel so far as the Society is concerned. The whole week's programme was carried out with a measure of success that reflected the utmost credit on all who had any share in its planning. The only criticism we have to offer relates to the absence of advance copies of the papers. In fairness to the members the Society should insist that authors should submit their manuscripts sufficiently early to permit every member to receive a printed copy before the commencement of the meeting at which they are to be presented.

A Postponed Voyage

CANADIAN and American chemists and chemical engineers who have just recrossed the Atlantic after three full weeks of conference and holiday-making in this country are looking forward with obvious pleasure to the next visit of the Society of Chemical Industry, already long overdue. They have returned with favourable impressions of the successful way in which the British chemical industry has weathered the storm of the industrial depression and are determined to put into practice some of the lessons they have learnt here. The Society was to have visited Montreal for its next meeting, but 1937 will be Coronation year, and so the visit has again been postponed. The Yorkshire section has promptly stepped into the breach and invited the Society to go to Harrogate for the 56th meeting. This marks a happy departure from previous practice, which appears to have decreed that the Society should always meet in an industrial city. Harrogate is an ideal venue for a July conference, and at the same time it is near enough to Leeds to afford facilities for all the works visits the members may desire.

Banking and Industry

A PERTINENT commentary upon the plea so often heard that banks should do more to assist industry has been the announcement made during the past week of the conclusion of negotiations whereby the Bank of London and South America is to take over the business and liabilities of the Anglo-South American Bank. The Anglo-South Bank has been in trouble since 1931, and although these troubles were intensified by the world crisis, they were due mainly to the very large commitments of the bank in nitrate, the assets representing which had become frozen. What happened was that in 1900 the shipments of nitrate from Chili and Peru were 1,400,000 tons, and by 1912 they had continuously risen to 2,542,000 tons; the industry was on a wave of prosperity, having as its only serious competitor, by-product ammonia. Nitrate was one of the soundest investments, to all appearances. But a change was at hand. In 1913 no less than 54 per cent. of the world's nitrogen consumption was in the form of Chilian nitrate; by 1922 the proportion had dropped to 23 per cent.; last year the proportion was but $7\frac{3}{4}$ per cent. The drop in percentage, moreover, corresponded to a decrease in output, and last year only 178,400 tons of nitrate nitrogen were produced, corresponding to less than 1,150,000 tons of commercial nitrate. The reason is not far to seek; it is the same cause that produced grave difficulties in the economics of the carbonising industries by the elimination of by-product ammonia as an asset on the balance-sheet—namely, the coming of synthetic ammonia.

Effects of Chemical Synthesis

OF the 2,041,366 tons of total nitrogen produced in various forms as fertilisers last year, no less than fifty-five per cent. was synthetic ammonia. Haber and Bosch, with the aid of the Badische Company, have wrought this change, and so early as 1923 nitrogen fixation supplied the bulk of Germany's nitrogenous fertilisers. The moral of this rather disastrous chapter in the history of banking is clearly that financial houses when investing their funds must for the future take into account the possibility that chemical synthesis may, like a thief in the night, steal away the assets. We would ask whether petroleum will go the same way as nitrate? To-day the production of synthetic oil looks more promising than did the production of synthetic ammonia in 1912; though that is not saying much for its apparent prospects. A further moral is that financial houses, and banks in particular, should keep among their staffs at least one chemist with full knowledge and vision of the shape of things to come. Such a chemist could probably have foretold the rise of the synthetic nitrogen industry and its effect upon Chilean nitrates before the Anglo-South Bank had made its disastrous investments. As an example, in a chemical book published in 1915, and now lying before us, there occurs the statement that "The problem of directly uniting the oxygen and nitrogen of the air to form nitric acid and nitrate was first solved in a commercially successful form in 1903 by Birkeland and Eyde." That fact alone, even though it depended upon cheap water-power, would have been sufficient, even at that early date, to make a chemist chary of advising too drastic investments in a natural nitrogenous product.

Society of Chemical Industry

The Annual Meeting at Liverpool

THE annual meeting of the Society of Chemical Industry concluded at Liverpool on July 10 when a large party of delegates and guests visited the Dolgarrog works of the Aluminium Corporation, Ltd., and the Dolgarrog Power Station of the North Wales Power Co., Ltd. The visitors left headquarters at 9.30 a.m. under the leadership of Mr. F. Hirsch and travelled via the Mersey Tunnel, Queensferry, Mold, and Denbigh to Bettws-y-Coed, where lunch was served at 1 p.m. The party afterwards left for Dolgarrog where they visited the works and commenced the return journey at 4 p.m. Tea was taken at Llandudno and the party arrived back in Liverpool shortly after 8 p.m.

Presentation of The Messel Medal

The presentation of the Messel Medal was made to Sir Robert Mond on the morning of July 8 when delegates and guests gathered in the ballroom of the Adelphi Hotel for the function. In making the presentation, the President said they were gathered there to pay a tribute to one of their great leaders. Sir Robert had added so much lustre to an already distinguished name that they felt as a Society they shared in the reflected glory of that day's proceedings In addition to his great achievements in science, they had always regarded him as a great world ambassador in creating a better understanding between scientists throughout the world. They were all extremely pleased to hear of the honour conferred on him by the French Society of Chemical Industry in making him President of that Society. He considered it a very great privilege to hand Sir Robert the Messel Medal.

Dr. R. H. PICKARD, proposing a vote of thanks to Sir Robert Mond, at the close of his Messel Medal lecture, said the Society had had in the past several very distinguished medallists and he felt that all the members present, as well as the very much larger body of members who were not present, would cordially endorse the action of the Council in selecting Sir Robert as this year's medallist. It had been presented to men distinguished in many fields, but when they had as the medallist a man who had been a past-president of the Faraday Society and was now president of the French Society of Chemical Industry and also a man who had given service in fields other than chemistry, they were indeed happy in their choice. But the duty placed upon a medallist of presenting an address at the annual meeting of the Society had produced for their great gratification a paper dealing with certain phases in the life of a master of industry. Those of them who were occupied in research were inclined to think that research was the very finest and the most important part of commercial production of chemicals and other products. But they had before them a leader in a far more difficult field—the application of laboratory work to the commercial field—and the perhaps more difficult feat of applying the large-scale work to commercial requirements.

Dr. WM. CULLEN, in seconding, said he did not realise when he was asked to second this vote how opportune the choice was—if he might say so. There was scarcely a name which Sir Robert had mentioned whom he did not know personally, including his father—an association which he looked upon as one of the greatest periods of his career. He had been in direct or indirect touch with most of the workers whom Sir Robert had mentioned.

The Plastics Group Meeting

At the plastics group session on July 9, Mr. R. R. Butler, principal of the Liverpool Technical College, paid a tribute to the work of Mr. A. E. Findley, head of the Department of Chemistry, under whose guidance the department had become one of the largest and most successful in the College. Amongst the successes obtained in the examinations of the professional institutions during the last session eight Associateships and three Fellowships of the Institute of Chemistry had been obtained by students. Extending a personal welcome to Dr. R. Houwink, the lecturer, Mr. Butler said that the importance of synthetic resins in modern life was realised when one remembered that since 1916 more than 2,000 patents in the field of plastics had been taken out in the United States alone.

Dr. R. HOUWINK read his paper on "Synthetic Resins, Their Formation, Properties and Possibilities," a report of which appeared in THE CHEMICAL AGE last week.

The Father of Plastics

Dr. BAEKELAND said he had listened with deep interest to the words of wisdom of a young man full of energy and so eager that he barely had time to find words to express his rushing thoughts. In his younger years and not so very long ago whenever anybody found a substance which they could not utilise the wastepaper basket was the place for it. His little world was only just beginning, but when he saw a young man "putting a soul into a molecule" he was reminded of his student days at Ghent when they made fun of the "physiological chemists" because they dared to investigate substances which others had thrown into the waste-bin. That was the beginning of "physiological chemistry" which to-day was the vital modern science of biological chemistry.

The CHAIRMAN (Dr. L. A. Jordan) said the three materials covered by the lecture, rubbers, resins and glass, between which there was now seen to be no clear line of demarcation, affected the life of the community in an extraordinary manner. Schoolchildren were often asked to write essays on the effect on daily life of wireless and aviation, and he imagined that presently they would be set to describe what plastics meant to modern life.

Dr. G. S. WHITBY, of the National Research Council of Canada, an authority on rubber, said he could confirm an assertion by Dr. Houwink that a typically elastic substance like natural rubber behaved in the same manner as the resins at certain temperatures. He wondered what name would eventually be found for the synthetic substances that had elastic properties at ordinary temperatures, for it would be difficult to use "rubber" as a generic term for all, however derived. It seemed to him they might have to use some such name as "elastics" instead of "synthetic rubber."

Professor J. C. OLSEN, of Brooklyn Technical Institute, proposed a vote of thanks to the lecturer, and Mr. A. E. FINDLEY, of the Liverpool City Technical College, seconded.

Dr. HOUWINK, in reply, spoke of future developments and said the most urgent need was for stronger, more elastic and more shock-resistant products. The properties of the resins themselves must be improved along the lines which research indicated as being the most promising, and he drew particular attention to the requirement of greater strength, which, though already considerable, was at present only about one-thousandth part of its theoretical value.

I.C.I. Luncheon

The delegates were the guests at a luncheon on July 9, given by the delegate board of I.C.I. (General Chemicals), Ltd., at the Adelphi Hotel. Mr. F. W. Bain, M.C., chairman of the General Chemical Group, presided, and was supported by Mr. W. A. S. Calder (retiring president), Lord Leverhulme (president-elect) and Sir Robert Mond.

The CHAIRMAN, in welcoming the guests, said there were two reasons for that function. The first was that Mr. Calder was their's and the Society's president. He had filled the position of president that week with admirable distinction.

After paying a tribute to the work of Mr. Calder and referring to the fact that the name of Mond was once more prominent in the annals of the Society, he said they were proud and pleased to have so many representatives of the chemical industry in Canada and the United States with them. He had, he said, been in the United States recently, after an absence of four years, and he found a " simply astounding " change in the psychology of the people. Mr. Bain mentioned that the guests included the Mayor of Widnes (Mr. W. Connaughton) and the chairman of the Runcorn Council (Mr. P. Smith), representing an area from which the whole chemical industry in this country had sprung.

Sir HECTOR HETHERINGTON, vice-chancellor of the Liverpool University, in proposing the toast of " The Society of Chemical Industry," said his own and other Universities owed a great deal to the industry. Only the other day I.C.I. had given a new chemical laboratory to the University, and they also owed a great deal to Lord Leverhulme and his father and the firm they represented for the great help they had given not only to chemistry but on all sides of science, and he hoped for the sake of applied science and pure science that that association between the Universities and the industries of this country was long destined to endure. It was difficult to set a limit to the expanding importance of the industry represented by that gathering.

A Great Clan

The PRESIDENT, in replying, said they in I.C.I. were indeed a happy ship, and they in the General Chemicals Group were pleased to belong to a great clan. He referred in pleasing terms to the happy associations of the Group and concluded with a reference to the work of Dr. Baekeland.

Lord LEVERHULME, supporting a vote of thanks to the Company, said he came to that function in some trepidation whether they would be able to do as well at their dinner at Port Sunlight that night, but he consoled himself with the thought that their guests would say, " Poor devils, they have to pay so much to I.C.I. for their alkali, they cannot be expected to do as well."

Herr E. WEBER ANDREAE, head of the I. G. Farbenindustrie, referred to the change in his country and said the health movement was bringing up a cleaner and stronger youth. He considered it their duty to endeavour, not to decrease, but to increase the general desire of the ordinary people to continue friendly intercourse with every nation.

Professor D. D. JACKSON, of the Department of Chemical Engineering, Columbia University, associated himself with the thanks of the American visitors. The health of the Chairman was proposed by Alderman Edwin Thompson, past-president of the Society.

Dinner at Port Sunlight

Over 400 delegates were entertained at a dinner and dance on July 9 by the governor, chairman and directors of Lever Brothers, Ltd., in the Hulme Hall, Port Sunlight, and the Lady Lever Art Gallery.

Lord LEVERHULME presided at the dinner, and in proposing the toast, " Our Guests," cordially welcomed the delegates. The gathering, he said, was the most desirable which they could possibly entertain at Port Sunlight, for his company was dependent upon the work of chemists at every stage of its manufacturing processes. Dealing with the work of his father, he remarked that although he had little technical knowledge of the processes involved, he had the business acumen to carry out his plans to a successful conclusion. When the Port Sunlight factory was built it was regarded as a great advance on any other plant that had then been built. They had not allowed that advantage to lag behind, and he invited them to see the wonderful machinery they now had installed for the production of their manufactures. The factory as they saw it at Port Sunlight was designed and drawn to his father's own plans. He did not merely give a plan to the architect, but he drew it to scale. His father was not a scientist, but his genius rather lay in the field of business and administration.

Mr. W. A. S. CALDER spoke of the Society's wonderful week in Liverpool. Referring to Lord Leverhulme's father, he spoke of his great vision, and went on to refer to the invaluable work of the present officials of the Society. He then invested Lord Leverhulme with the " family jewels " of the Society—thus handing over the chain of office of the organisation before the appointed time, as he said—midnight on the last day of the conference.

Lord LEVERHULME, in reply, said that long before midnight on the last day, Mr. Calder had taken off his glass slipper and handed it on to the new Cindereila.

Scientific Research and the Highway Engineer

Road and Building Materials Group Paper

ROAD construction at present is largely based on the accumulated experience of engineers acquired as the result of successes and failures, said Mr. R. G. Batson, M.I.Chem.E., M.I.Mech.E., in his address to the Road and Building Materials Group of the Society of Chemical Industry on July 8. Owing to the urgent needs during the past few years for new and improved roads, and the necessity to have regard to economic conditions, the art has been outpaced by the demands made upon it. When new conditions or new materials are found, the craftsman is usually at a loss to know the best method of application, that is to say, he does not know the underlying reasons for his successes or failures. The natural tendency is therefore for the craftsman to be conservative in his outlook with the result that progress is retarded.

A man cannot successfully apply the latest scientific unless he is, to some extent, familiar with the methods, requirements and limitations of industrial research. For this reason the young engineer should have contact with research and his previous training should be such that his attitude of mind is prepared to benefit by it.

Unlike the more untrammelled conditions of research in pure science, it is essential in any industrial research that the ultimate objective should always be in the forefront and that each step taken should have a definite bearing on and lead towards that objective. The practical application of the work should be continually in mind. There is always the tendency for the research worker to become interested in a particular part of the work and try to develop it beyond the point where it has a direct bearing on the main programme before him.

Any systematic scheme of industrial research must deal with the important unknown variables one by one, although in some cases, in order to make progress, it is necessary to guess that certain variables are relatively unimportant. This seems inevitable in this type of work because time is so much a controlling factor, but it is realised that some of the most important research discoveries have been made by chance or successful guesses. Observations which appear to be relatively trivial during the progress of a research or investigation are sometimes of the greatest importance. It is therefore necessary that every factor should be recorded.

The practical significance of the results obtained must be judged by some form of quantitative test. This leads to the most difficult part of industrial research, *viz.*, the decision as to what properties are important and the means by which

they are to be measured. It is, of course, particularly difficult in road research. It may be argued that the "proof of the pudding is in the eating" and the criterion of the value of a road or building is how it behaves in practice. It is agreed that this is the basis on which final judgment is passed, but if it were the only method then the judgment of a problem or economy in construction would take very many years.

Full-scale testing is costly in money as well as in time. The method can, however, be applied if necessary and is adopted by some industrial concerns where the test result obtained is expressed in terms of the cost of maintenance over a given period of years. Full-scale experiments are carried out under the auspices of the Ministry of Transport. With the exception of the experimental road at Harmondsworth, none of these experimental sections have been laid by labour wholly under the control of the Ministry and most of them have been carried out in co-operation with county engineers and trade associations. The committee of the Ministry of Transport appointed to advise on this work came to the decision some time ago that, owing to the comparatively inconclusive results given by full-scale experimental work on surface dressing, further work should be suspended until some of the variables had been dealt with by laboratory tests.

Co-operative Experiment

In 1927, when the Ministry of Transport were carrying out experimental work on a co-operative "experiment" where the actual construction was being undertaken by a contractor, the opinion was expressed that the results obtained would not lead to definite conclusions and that the authority undertaking the experiments should have full control over everything appertaining to it. The results obtained fully justified that opinion. Subsequently concrete slabs were laid on the Harmondsworth experimental road by staff under the full control of the research workers, and in their report for 1934 the Experimental Committee of the Ministry stated that in their view "the provision of a second experimental road which could be closed to traffic as desired should no longer be deferred."

The alternative to full-scale tests is tests made in a laboratory or by laboratory apparatus. Small-scale tests involve three stages before such tests can be accepted as reliable "tools" for investigatory purposes: (a) Determination of the property or properties which are important; (b) design and construction of apparatus to measure those properties and development of technique connected with the tests; (c) correlation of the results obtained by using the apparatus, with those given in practice. Each of these three stages represents a large amount of work and expenditure of time, but once they are all completed, rapid progress can be made towards a fourth stage, *viz.*, (d) application of the technique towards improvement in materials and methods of construction. But such work, though quicker than full-scale work on the highway, is nevertheless slow initially, for a large amount of "spade-work" is necessary before the "crop can be gathered in."

Research of this nature into road problems has only been in progress a few years and many of the subjects requiring investigation are still in one of the three earlier stages just mentioned. Much depends upon the correct diagnosis of the problem for stage (a), and in this respect a great deal can be learnt from a study of failures and successes—more particularly failures.

Concrete Construction

Concrete has only comparatively recently been used extensively in road and building construction. Mr. H. P. Boulnois, in his book "Modern Roads," 1919, states that "hitherto the attempts that have been made in this country to construct unsurfaced concrete roads have not met with much success, although in the United States and elsewhere many millions of square miles of roads of this form of construction have been laid. In this country only a few thousand yards have been laid and, in some cases, these roads have not been altogether satisfactory." Two of the objections raised by Mr. Boulnois to concrete road construction were: (1) The concrete must be very rich in cement in order to secure success and this makes it an expensive road to construct in comparison with other forms. (2) Such a road would require most careful and constant supervision during construction.

United States Investigations

Duff Abrams in the United States carried out an extensive investigation on "concrete." He decided that the properties on which it should be judged were its compressive strength and the amount of wear. Compression testing machines were well known, but he had to decide upon the dimensions and form of test piece which would give comparable results. He devised a rattler form testing machine for measuring wear. One of the principal conclusions from his work was that "with given concrete, materials and conditions of test the quantity of mixing water used determines the strength of the concrete, so long as the mix is of workable plasticity." He further found that a complete analysis of the water requirements showed that the amount of mixing water required was governed by six factors: (1) The conditions of plasticity or workability required of the concrete. (2) The normal consistency of the cement. (3) The size and grading of the aggregate. (4) The relative volumes of cement and aggregate, *i.e.*, the mix. (5) The absorption of the aggregate. (6) The water contained in the aggregate.

The smaller the amount of water used the stronger the concrete, *provided the mix is workable*, or in other words, provided the concrete is completely compacted. Work carried out at the Building Research Station showed that the grading of the aggregate used, within very wide limits, was immaterial if *both* these conditions were fulfilled, but that the amount of water required varied with different gradings to secure the plasticity required for placing the concrete in position. Before an investigation into the best gradings of aggregate for concrete could be carried out, another property of the mix required measurement, *viz.*, its workability. A method has been devised and an extensive series of tests are in hand with a view to exploring the factors in an aggregate which affect this property. It is hoped that this investigation will enable the engineer to determine which of the various aggregates available to him will require the least amount of water per mix, and therefore produce the strongest concrete for a given workability.

The Slippery Road

The slippery road problem is of interest to the road user as well as the engineer. When the research into this matter was started in 1927, the research worker was told to "investigate the skidding of vehicles on road surfaces." The problem naturally divided itself into two parts, (a) the condition of the road surface, (b) the effect of the vehicle design—brakes, weight distribution, etc. As regards the road surface it was naturally decided that the property requiring measurement was the frictional resistance between the tyre and the road.

In order to compare road surfaces it was necessary to devise a method of measuring the frictional resistance. There are two forms of slippings: (a) When the brakes are applied so that the slip occurs as the wheel is revolving, or when it is braked, (b) slip at right angles to the direction of rolling. It was decided first to investigate the latter, and a small laboratory apparatus was designed and constructed for the purpose. Attempts were made with the apparatus to correlate results with actual road conditions. A slab was cut from a road which was known to have been the cause of many accidents (*i.e.*, a failure), and tests were made on this and other surfaces under all kinds of natural atmospheric conditions. The only occasions on which low values were obtained were when the surface was coated with ice. The maximum speed with the apparatus was 2 ft. per

second, and there were slight indications of the reduction in frictional coefficient with speed. It was then decided to design and construct an apparatus which was in the form of a vehicle using the road and test under " full-scale " conditions.

Information has been obtained as to some peculiarities of slippery roads and the necessary requirements to make roads non-skid. The process has been long (*viz.*, about ten years) and in order to obtain data on which improved construction can be designed small-scale work is necessary if progress is to be expected in a reasonable time. Some of the requirements of laboratory apparatus for this work have been shown by the full-scale work, the principal points being: (a) The lubricating film between the tyre and the road, (b) the relative speed, (c) the roughness of the road, (d) the roughness of the tyre. A small-scale skidding apparatus was designed at the Road Research Laboratory for this purpose.

So far as Government research is concerned work on bituminous roads is in the early stages of its progress. It is fraught with many difficulties, many of which are associated with the application of a plastic binder to a construction which has to stand heavy loads. Full-scale road experiments have been carried out for many years, first by the old Road Board, and then by its successor, the Ministry of Transport. Many industrial firms and some county and city engineers obtain full-scale information by making small variations in their products supplied and laid in connection with road contracts and usually, in association with this work, undertake small-scale tests in their own laboratories. Improvements are effected by this means which enable them to keep pace with the increased demands made on the road structure and build up methods of control applicable to their own products. These methods are often not disclosed to the independent research worker and, when they are, it is usually found that they are only applicable to a very limited range of products.

The three major reasons why bituminous roads fail, and excessive maintenance is taken as failure, are: (1) The development of a slippery surface, (2) excessive deformation, (3) disintegration. These reasons are apart from considerations of foundation troubles. Each component of a bituminous road (binder, stone, filler, etc.) requires separate examination besides the final consolidated mixtures. As regards binders, knowledge is required on (a) viscosity characteristics, such as viscosity-temperature relationships, extent of departure from ideal fluidity, etc., (b) ductility, (c) surface tension and wetting properties towards aggregates when dry or in the presence of water, (d) elasticity and high rates of strain, (e) changes in the above properties (c) and (d) with time, and due to exposure to wind, stagnant oxygen, heat, light and other atmospheric conditions. Researches into those properties are actively in progress at the Road Research Laboratory on tars and soft pitches in co-operation with the British Road Tar Association.

Wood Pipe for Chemical Liquors

By JOHN D. WATSON

ONE would not casually regard timber as a material suitable for any form of pipe unless something of quite a rough and ready nature, though as a material which will stand up to corrosive and other conditions which would speedily destroy any iron or steel pipe it can serve a useful purpose in this direction. As a matter of fact pipe made of bored logs was probably the original means of conveying water under pressure. They are still sold for this purpose in North America where quite an appreciable business is done in wood stave pipe. For water supply and power projects there are in existence in the western States of that Continent and in other parts of the world wood stave pipe lines, of anything up to 10 ft. diam., totalling several hundreds of miles, but the class of pipe referred to here is rather different though the principles of its construction are pretty much the same.

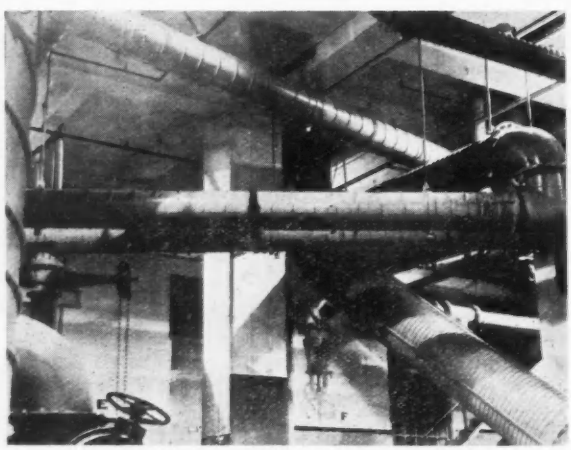

Fig. 1.—Continuous and wirewound wood stave pipe installed in a paper mill at Powell River, British Columbia. All fittings such as bends, tees, etc., are copper-lined. Valves are bronze fitted, all to avoid paper stain in the manufacture of paper.

Used extensively in paper mills and chemical works, or in any situation either where there is corrosive liquor to be handled, or where metal pipe would contaminate any water or liquor passing through it, the two principal varieties are shown in Fig. 1, the upper pipes being bound with individual bands and the larger lower pipes being of the continuous wire wound class. The former, as might be obvious, is not at all difficult to make by hand from suitable sections of timber and while that is the manner in which continuous wood stave pipe of large bore is constructed, it is the wire wound pipe which is the more generally suitable to the present purpose.

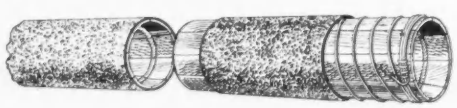

Fig. 2.—Wood stave pipe, slip joint.

Its general form is seen in Fig. 2, which shows a comparatively light pipe for low pressures, one end being bored out to form a socket and the other one turned down to form a spigot, the one being a push fit in the other. Swelling of the timber is all that is necessary to render the pipe tight, the wire, as will be apparent, binding the staves into the necessary circular form and resisting any tendency for them to spread out under pressure. Fig. 3 indicates the form in which these staves, which are usually of Douglas fir or Canadian redwood, are milled. The average size of such pipe is round about 12 in., though it can be made up to 24 in., in individual lengths up to 20 ft. and, according to the spacing of the binding, it can carry pressures up to 250 lb.

It will be seen from Fig. 3 that the staves are milled to the correct circle on the sides and to the correct radius on the edges where there is a small locking tongue or groove. For pressures up to 200 lb. the finished thickness of the staves is

1⅛ in. for pipes 6 in. to 12 in. diam., 3/16 in. for those from 13 in. to 18 in. diam., and 1¼ in. for 19 in. diam. and over, but the form of pipe shown in Fig. 2, while perhaps the more generally useful because it is cheap and has a metal-free joint, is limited in the pressure it can carry by reason of the joint.

Without weakening the wall of the pipe, a metal-free joint can be made in the form of a wood sleeve or collar which is not much more than a length of pipe whose internal diameter equals the external diameter of the pipes it serves to join less about ¼ in. to enable it to be a push fit on the trimmed down ends or tenon of the pipe. It is a simple arrangement but becomes rather clumsy, and it may add to the difficulties of installation on this account. For that reason when the pressure is higher than is deemed suitable for the slip joint shown in Fig. 2, the coupling shown in Fig. 4 is used. Being flush inside and out, it does

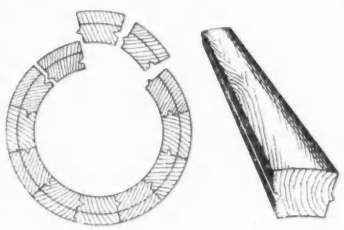

Fig. 3.—Form of stave for wood pipe.

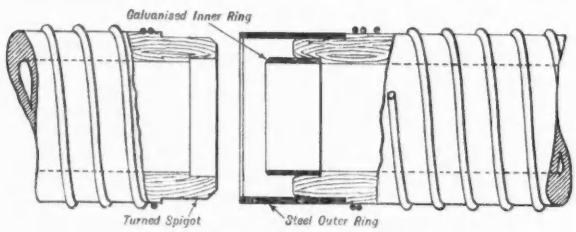

Fig. 4.—Collar joint for wood stave pipe.

not upset the flow of liquid in the pipe nor prevent the external wrapping shown in Fig. 2.

Leaving this particular matter for the moment, the joint shown consists of a relatively heavy outer ring and a lighter inner one fitted to one end of the pipe. A turned spigot on the other end of the next section is driven snugly home between these rings where, on swelling, it forms a very tight joint. The inner ring, which is about 2½ in. wide, is seated in a machine-turned recess in the internal bore and it fits flush with the inner surface. Its purpose is to hold the staves of the pipe firmly against the outer ring and it also fills up the gap between the adjacent butting lengths. The outer ring may be 4 in. or 5 in. wide or more, according to the size of the pipe, and it is made of heavier gauge material than the inner one and fitting flush with the body of the pipe, it makes a neat unobtrusive joint. The chamfering of the ends of the rings should also be noted, as this facilitates the driving of the pipes together without damage to the spigot end, and the inner ring should be galvanised or be made of Monel or some other non-corrodible metal when this is necessary, while the outer one should be well tarred or, for preference, asphalte coated.

Obviously the main advantage of wood pipe in the present connection lies in its ability to provide a cheap light conduit for the conveyance of those liquors from tanneries, chemical works, mineral reduction plant, yeast factories, soap works, pickling works, vinegar breweries, users of lye and similar industries, which contain acids or alkalies of such strength to preclude the use of metal. While its use may be rather limited by the necessity for the metal fittings shown in Fig. 1, for forming bends, elbows, junctions, etc., the pipes can always be suitably lined. The connection between the wood and metal is made by means of a caulked lead sleeve similar to the finished joint in cast iron pipe practice and against which an expanded tenon drives solidly. This lead sleeve is poured within the socket of the fitting against a perfectly smooth turned metal plug corresponding to the shape of the tenon, the lead being caulked prior to the removal of the plug. Any flange connections are made in a similar manner by having the flanges cast with the required spigot lined as indicated.

The accompanying illustrations will indicate the usual method of binding the pipes for which purpose a strong heavily galvanised steel wire is required, though where conditions require it, this may be copper or phosphor bronze wire of the appropriate strength (60,000 lb. per sq. in.). It is important that it be wound on at sufficient tension to actually bed into the timber, but not so much as to damage the fibres, and attention is directed to the method of finishing off the binding (Fig. 2). Then, after the initial swelling, there is little fear of wood stave pipe leaking.

Durability of the Coating

In the matter of its durability, the external coating is rather important if there are fumes or other influences which would attack the external surface or its binding. One which can be cheaply applied is formed by dipping the pipe in a bath of hot asphalte at the proper consistency. The pipe should be rotated on adjustable bars in the vat until all the parts are thoroughly coated and then, if rolled in fine sand, a neat, durable and firm coating will result. Sand is much preferable to sawdust and, of course, it must be thoroughly well washed and dried first and the asphalte used should be a high grade air-blown product with a melting point of 170°. The pipe is dipped complete with any steel couplings.

A burlap wrapping gives an added protection. This is done by machine-winding a double covering of 8 in. wide burlap applied under tension to the whole of the outside of the pipe except the spigot. If the machine is spaced to travel 3½ in. at every revolution, it will ensure a thorough two-ply covering of the pipe. Just in advance of the burlap, a small pump should be arranged to spray hot asphalte over the pipe coupling and wire before the burlap reaches the pipe, while the burlap itself is thoroughly saturated by passing through the hot dip before it is wound on. The pipe is then rolled in fine dry sand so as to form an outer jacket which should adhere very firmly after cooling.

Attention to Leakages

As stated, if all this is carefully done with a full appreciation of what is required, wood stave pipe should be "drop tight" after it has had a week or two to get thoroughly soaked; whenever possible it should always remain full, but full pressure should not be applied till the pipe has had two or three days to get well soaked. After that the longitudinal seams will soon take up, small leaks being usually due to pith holes, which can be easily closed by means of a small plug whittled to fit the hole. If leaks should still be present or occur later in the slip type of joint, slim tapering taper wedges of cedar about 1 in. wide can be driven in at the points where the leaks occur, care being taken to see that the end of the wedge is not driven in any deeper than the thickness of the shoulder on the socket portion of the joint. If there has been continuous leakage to such an extent that some of the wood has been eroded away, this must be caulked up with oakum before driving wedges in the joints on either side.

Where leaks occur in a collar joint, which they are rather prone to do, an attempt is often made to stop them by plugging wedges or oakum between the collar and the pipe itself. This is quite wrong. They must be driven into the end of the collar after an incision has been first made with a chisel. Into this opening the wedge must be driven so as to force the wood of the collar against the tenon of the pipe, but in doing this one has to take great care not to split the stave of the collar, and it is not advisable to drive any one wedge in deeper than about 1 in. It should then be cut off and further wedges driven into the other staves until the leakage is stopped. It very rarely happens that a leak cannot be stopped by the careful application of *thin* wedges—it is thick wedges roughly hammered in which not only prove ineffective but may actually start fresh leaks.

Research Activities of Mellon Institute, 1935-1936

Industrial Uses for New Organic Compounds

TWENTY-FIVE years ago the industrial fellowship system of Robert Kennedy Duncan, the investigational procedure of Mellon Institute, was established at the University of Pittsburg by Andrew W. Mellon and Richard B. Mellon. The first industrial fellowship had begun work at the University of Kansas in 1907. In 1913 the Kansas and Pittsburg units were combined in Mellon Institute of Industrial Research, founded and later placed on a permanent basis by the Mellon brothers.

For an industrial research organisation to be able to celebrate a quarter-century of uninterrupted activity and growth is indeed a sign of maturity, and it can be said with gratification that the Institute now has greater vigour than ever before. Since 1911 the Institute has had 1,085 industrial fellowships on 268 different subjects of technology, on which 935 scientists and engineers have been employed. Over 500 new or improved processes and products and nearly 2,000 contributions to the literature of pure and applied science have resulted from these researches. From 1911-36, 363 fellows and 414 fellowship assistants of the Institute, having completed their services in the Institution, have entered the fields of manufacturing, commerce, and education. As trained additions to the forces of industry and teaching, these men, many of whom are specialists of high professional standing, constitute the Institute's most valuable gift to humanity.

Industrial Fellowships at Work

Throughout the fiscal year 1935-36, 19 multiple and 47 individual industrial fellowships have been at work. These different investigations have required the services of 102 fellows and 69 assistants. Thirty-one fellowships have been working for five years or more, and of this number 13 have concluded 10 years of research, 10 have been active for 15 years or more, and 4 fellowships are 20 years of age or older.

Ten fellowships began operation during 1935-36, those of chemical interest beng concerned with soya beans, bone black, lead, protective coatings, yeast and bone products.

The period covered by the 1935-1936 report is characterised by the number and variety of new products of commercial promise that have come from fellowship investigations. Among these novel creations are an opal glass, two marble products, a group of refractories, several series of organic compounds, a synthetic resin, a safety glass, a speciality paper, an alloy steel for safety-razor blades, and several waterproofing agents for open fabrics.

Another recent achievement, the black lacquer intermediate "Coblac," of which a detailed account was included in last year's report, has been favourably received by the lacquer industry throughout the world and is enjoying constantly increasing commercial success. Studies by C. W. Sweitzer on the Columbian Carbon Co.'s fellowship, showing that concrete can be darkened as well as strengthened by the use of aqueous dispersions of carbon black, have facilitated the introduction of these products in the highway construction field. The discovery that small percentages of carbon black improve remarkably the workability and strength of sulphur-aggregate compositions has resulted in the use of carbon black for this purpose in several commercial sulphur cements that are finding more and more employment in the industries.

A Co-operative Programme

A co-operative programme of research and development established in 1935 by the American Rolling Mill Co. and the multiple fellowship on protected metals of the H. H. Robertson Co. has made possible the extension of the metal-bonding process to the manufacture of protected galvanised "Armco" iron and steel culverts. The metal-bonding process, described in prior publications of the Institute, has been utilised for attaching asbestos fabric permanently to galvanised iron by means of the zinc coating thereon. This asbestos layer is impregnated with asphalt to make it impervious to moisture, and an asphalt paving is then superimposed on the saturated asbestos layer, the asbestos forming a permanent bond between the steel and paving. Such treatment results in the formation of a highly serviceable metal culvert protected by successive layers of zinc, impregnated asbestos, and asphalt paving, all bound to the iron base by the zinc adhesive.

The fellowship of the Philip Carey Co. has carried on studies in the high-temperature field. In this domain the designing engineer has generally used an emissivity value of 0.80-0.95 for refractory materials, with no regard to the colour of the refractory. Within the last two years, however, the fellowship has found the emissivities of refractories of a number of different colours and has concluded that, contrary to general belief, the emissivity of light-coloured refractories decreases rapidly with increase in temperature, the decrease starting at a temperature of about 400° F. These results will be of interest to metallurgists and of particular concern to electric furnace operators, to whom the cost of energy is a highly important factor.

Research on Glass

The fellowship of the Macbeth-Evans Glass Co. has worked out a technique for preparing laboratory glass melts in platinum, by which small melts can be made without danger of contamination from the crucible and at a cost much lower than that possible with fireclay or silimanite crucibles. The application of spectroscopy to glass analysis has been studied and a technique developed for obtaining qualitative and even semi-quantitative results. For example, it has been found that fluorine may be determined in glass spectroscopically in a semi-quantitative manner by proper preparation of the sample and examination of the calcium fluoride bands.

The chief activity of A. P. Thompson on the abrasives fellowship has been to act in a liaison capacity between the research laboratory of the Carborundum Co. and the industries in the development of a series of novel refractories to which has been given the generic name "Monofrax." These refractories are produced by melting selected raw materials in the electric furnace, followed by casting in much the same manner as in the case of a metal. Obviously, because of the wide range of conditions that refractories must withstand in service, there can be no universal refractory. Fusion in an electric furnace, however, permits the choice of a wide range of materials, principally refractory oxides, thus providing the definite composition best adapted to each type of application.

The production of a refractory by this procedure gives a dense, impenetrable, crystalline structure possessing a high degree of stability, without the use of the bond that is characteristic of the ordinary refractory. The usual refractory generally fails because of surface attack by combined chemical and physical processes and because of penetration of the pores and consequent destruction of the less inert band, thus dislodging pieces of refractory even before they are dissolved. A refractory of the "Monofrax" type not only eleminates the latter because of failure, but also presents a minimal area for attack because it has an impervious surface.

Organic Synthesis

The Carbide and Carbon Chemicals Corporation's multiple fellowship has continued studies of the derivatives of ethylene diamine, morpholine, and piperazine. Propylene diamine and phenyl morpholine have been produced on a small scale, and applications have been developed for these amines in the preparation of pharmaceuticals, dyestuffs, accelerators, and wetting agents. The use of other amines for the purification of gases and liquids has been investigated.

A number of these compounds have been prepared by new methods of synthesis; some of these compounds are new, others have been known, but now, owing to improved methods of preparation, may become of industrial importance for the first time. Among these compounds are certain acetoacetyl-aryl amines, which, when coupled with diazonium compounds, form dyestuffs. These amines include acetoacetyl alpha-naphthylamine, acetoacetyl beta-naphthylamine, gamma-chlor-acetoacetanilide, diacetoacetyl benzidine, and diaceto-acetyl ortho-tolidine. Several hydroxymethyl quinoline derivatives have been prepared that should be of value in the pharmaceutical field as sources of disinfectants, as inhibitors, and as dyestuff intermediates. These derivatives include 2-hydroxy-4-methyl quinoline, ortho-chlor-2-hydroxy-methyl-quinoline, 2-hydroxy-4-chlor-methylquinoline, 2-hydroxy-4-methyl alpha-naphthoquinoline, and 2-hydroxy-4-methyl beta-naphtho-quinoline.

New Types of Resins

The development of new types of resins by this fellowship has been carried on, and a new product of the "Vinylite" type, known as "Vinylite X," has been evolved for use in safety glass. It has been found necessary to develop a new type of plasticiser for this resin; and the composition containing this resin and plasticiser, as used in safety glass, is called "Vinal." This plastic may be worked and sheeted by the same process that is used for cellulose acetate and nitrate. The sheets, produced by any of the standard methods, are placed between plates of glass, and the resulting sandwich is subjected to heat and pressure to obtain adhesion of the plastic and glass. The resulting product is quite superior in every respect to any other type of safety glass. As to break resistance, it will stand approximately ten times as great a blow at — 10° F. and five times as great at 700° F. as any other variety of safety glass. The plastic is resistant to ultra-violet light and withstands 1,000 hours' exposure to the "Uviarc" without discoloration. The saftey glass made with this plastic has been subjected to a temperature of 260° F. for 200-300 hours without showing any change, whereas the present type of safety glass is discoloured within 40-60 minutes.

The new plastic adheres readily to glass; consequently, an adhesive is not required and the safety glass does not require edge-scaling, as the penetration of moisture does not affect the adhesive qualities that cause "let-goes" or shrinkage along the edges. The plastic is quite elastic and yet is very strong, which are highly desirable properties for safety glass. In this glass it tends to absorb blows, thereby conducing to the elimination of the conchoidal pieces of glass that are ordinarily knocked from the inside plate directly opposite the point of impact.

Considerable work has been conducted on industrial uses for a number of new products that are being made on a semi-commercial scale. Among these compounds may be mentioned acetonyl acetone, butylidine acetone, butyric anhydride, dichlorisopropyl ether, diethyl "Carbitol," diethyl ether of diethylene glycol, diethyl aminœthanol, octoic aldehyde, tetraethyl orthosilicate, and several new types of wetting agents.

A New Speciality Paper

The advantages of co-operative work between fellowships interested in entirely different fields is well illustrated by the development of a new speciality paper by the Strathmore Paper Co.'s fellowship. Through the Mellon Institute system the Sugar Institute, Inc., had been seeking new uses for sugar and had devised a commercial method for the production of sucrose octaäcetate. The applications of this compound in paper technology were then studied by the Strathmore fellowship, which found it imparted to certain papers a mellow translucency that has suggested its use in greeting card stock or other kindred speciality papers where strength, pleasing texture, excellent printing properties, and translucency are important considerations. A speciality paper having these properties is now being considered for manufacture under U.S. Pat. 1,996,857 and 1,996,858.

The Fellowship of the Pittsburgh Steel Co., which was established in 1927 for research on steel and wire products, has been carrying on several diversified and broad investigations. Papers have been developed for use on paper-backed building fabrics; bright annealing processes for wire have been perfected, including a coating for protection against rust; several wire-drawing lubricants have been developed, and the effect of cold drawing on various physical properties of wire has been studied.

In addition to this basic work there has been installed a specification department, whose function is to define all details of processing procedure for each and every wire requirement of the customer. This procedure makes the scientific data obtained from fundamental researches easily applicable to production and provides the donor's customers with the advantage of scientific control and scientific uniformity so necessary for their needs. For manufacturers' wire, properties such as tensile strength, hardness, elongation, bend test, and finish are of extreme importance. Definite relationships among these factors and the composition of the steel and the nature of cold work have been found that enable accurate prediction of ultimate results. The proper finishes for various fabricating operations have also been carefully studied and means have been introduced for producing finishes that have led to better fabricated products, with less wear on the manufacturing equipment.

Advances in Textile Finishing

The industrial fellowship of the Onyx Oil and Chemical Co. and associated companies has continued investigations relating to processing compounds for textile finishing. Particular attention has been given to the improvement of preparations for the water-proofing of open fabrics. The water-repellent properties of an extensive list of available proofing agents have been explored by measurement of interfacial contact angles; and procedures have been developed for preparing the most active agents in the form of concentrated aqueous emulsions, which were required to be fluid, stable, of controlled pH, effective from extremely dilute baths, and compatible with auxiliary agents used to modify the appearance or feel of the finished fabric. This research has led to the manufacture of new products now being offered to textile mills. The fellowship has also co-operated with the donor in certain investigations pertaining to a new line of sulphonated products for use as wetting, emulsifying and levelling agents.

In co-operation with the smoke abatement fellowship there has been preliminary research, using experimental animals, to determine the effects of mixtures of air with flue gases and accompanying solids. While no definite conclusions have been reached, there is evidence of the harmfulness of some of the air-diluted products of combustion of certain fuels, and a more scopeful investigation is being planned. The concentration of benzine in flue gases and in atmospheric air is now being determined.

Research in Pure Chemistry

The year 1936 marks the tenth anniversary of the formation of the Department of Research in Pure Chemistry, which is headed by L. H. Cretcher, aided by C. L. Butler, senior fellow. During the year 1935-36 investigations in the field of cinchona alkaloids have been continued with the aim of finding compounds of therapeutic value, particularly in pneumonia. To date, sixty-six preparations have been tested biologically by Drs. W. W. G. Maclachlan, H. H. Permar, John M. Johnston, H. H. Burchell and Joseph R. Kenny, the medical collaborators at Mercy Hospital, Pittsburgh. As the most favourable preliminary results were obtained with hydroxyethylhydrocupreine, apocupreine, ethylapocupreine, and hydroxyethyl-apocupreine, clinical studies have been carried out with this group of substances, except hydroxyethylhydrocupreine.

The serious eye effects associated with high pneumococci-

cidal activity in ethylhydrocupreine are well known, and hence the evaluation of other pneumococcicidal cinchona derivatives involves careful consideration of this factor. Results obtained by the medical collaborators have shown that ethylapocupreine has a very high activity against the pneumococcus in vitro, in animals, and in humans, but that this activity is associated with serious visual disturbances. This eye effect has been studied in dogs by Professor W. T. Dawson, School of Medicine, University of Texas, and by Dr. Permar. Apocupreine itself was revealed to have considerable activity in vitro and in animals. When tested clinically, it was not found to be connected with any visual trouble, but it had only slight pneumococcicidal activity.

Hydroxyethylapocupreine is the most promising drug that has been found up to the present. Thorough tests of it in vitro and in animals have shown high antipneumococcic activity, lower toxicity than optochin or ethylapocupreine, and freedom from visual disturbances. Hydroxyethylaprocupreine has also been tested in twenty-six clinical cases, which have demonstrated a very high tolerance in the human to the drug, absence of any visual effects, and a high proportion of recoveries from severe pneumococcic infections of all types. In view of the great interest in hydroxyethylapocupreine and the difficulties involved in its preparation, considerable attention has been devoted during the year to the study of this substance.

Other activities have included the publication of papers on miscellaneous alkaloids and some hydrocupreine ethers (C. L. Butler, W. L. Nelson, Alice G. Renfrew and L. H. Cretcher), ketone formation with sodium amide (Alice G. Renfrew and L. H. Cretcher) and apocupreines (C. L. Butler and L. H. Cretcher), and the preparation and testing of isopropylapocupreine. The latter proved to have high pneumococcicidal activity in vitro and in animals, with toxicity in the range of ethylapocupreine and ethylhydrocupreine; but it shows serious eye effects in dogs (Professor Dawson and Dr. Permar) and consequently was not tested clinically. U.S. patents have been granted on apoquinine preparation and on various hydroxyethylatetd cinchona derivatives. This protection was deemed necessity in order to ensure proper production and distribution of these substances, should their apparent usefulness be confirmed by more extensive clinical tests.

The Co-ordination of Metabolic Inductive Emissions

By MAURICE COPISAROW, D.Sc.

INDUCTIONS from external sources and their influence upon organic life are familiar to us at least in their broad outline. Such inductions are based on atomic and subatomic physics with ramifications into molecular physics and chemistry. At this point a link is found, by way of inorganic, metallo-organic and ultimately organic* reactions, with inductions of metabolic origin. Such a link, though strengthened by general considerations of energy levels and cycles, as well as photon-electron relationship, does not, however, prevent metabolic inductive emissions to appear to us discordant or even obscure.

The function of such emissions within the organism is naturally greatly varied, but all may be traced to a common source, and may be co-ordinated on a single physico chemical basis. We may recognise among such protoplasmic inductions (a) electrical phenomena, (b) visible rays, and (c) ultra-violet radiation.

Dealing with metabolic electrical phenomena, such as the electrical potential associated with the nervous system and cell surfaces in general, we find these to be based on a range of physical and chemical reactions. As an outcome of the former we have frictional, capillary-electrical or electro-kinetic phenomena (Helmholtz and Smoluchowski). The chemical concepts regards ionic dissociation at surfaces to be the result of oxidation-reduction processes (Gouy, Debye and Hückel). So the electro-motive force in living tissue is based on ionic dissociation, the highest electric positive potential corresponding to the region of most intense respiration or oxidation, which takes place at the cell-phase boundary. In magnitude these electric currents may vary from the feeble nerve impulses to the shocks of the electric eel. In the case of metabolic inductions in the visible spectrum range, we find phosphorescence or bio-luminescence to be exhibited by various types of bacteria, oceanic micro-organisms, fungi, mollusk pholas, glowing sea worms or syllids, glow-worm, fire-fly, and probably extending to higher organisms. From the work of Beijerink and Harvey[1], Hayasi and Okuyama[2], and Warburg and Christian[3], it appears that this bio-luminescence is a function of oxidation enzymes. In contrast to lactase-dehydrogenase and oxidase basic to mitogenetic radiation, these enzymes are stable to carbon monoxide and hydrogen cyanide and constitute apparently a new type of oxidation enzyme distinct from peroxidase and glutathione.

An interesting extension of our knowledge as to the conditions and functions of bio-luminescence is provided by the deep-sea bathysphere investigations (2,500 ft.), in which regions of absolute darkness this type of radiation appears to be the main motive force or organic life (Beebe and Barton). Thus bio-luminescence seems to be brought about by (1) the temporary intensification of the enzymic oxidation processes, such as we find in various forms of excitation (day and night, seasonal, mating, etc., variations), or (2) oxygen compression, as in the case of deep-sea organisms—where this type of radiation becomes a permanent feature. Recent researches have also shown metabolic inductions to include radiation in the ultra-violet spectrum range (mito-genetic or Gurwitsch rays) as an intrinsic function of oxidation enzymes (oxidase-dehydrogenase), being general both to flora and fauna[4].

It thus follows that metabolic radiation, both in the visible and ultra-violet portion of the spectrum is a function of various phases of enzymic activity. The identification of certain oxidation enzymes with colouring matter of known constitution belonging to the flavine group[5], and still more the tracing of such groupings as hexose-diphosphoric acid and the dismutation of phospho-glyceraldehyde[6], not only provide a unifying basis for metabolic radiation, but also bring this phenomenon into line with known inorganic and metallo-organic sources of radiation.

If we consider (1) the interdependence of contact and inductive reactions, and (2) the physico-chemical identity of the dispersed colloidal state, characterising enzyme activity, and the large surfaces intrinsic to the metabolic electric potential—we perceive that the oxidative processes represent a co-ordinating basis for all these phenomena—a basis wide enough to accommodate other metabolic radiations still puzzling students of physiology and psychology.

* So we have chemi-luminescence in (a) the oxidation of formaldehyde in presence of alkaline pyrogallol and hydrogen peroxide and (b) on treating phenols and certain dyes with hydrogen peroxide and ferrous sulphate or ozone.

(1) Beijerink—" K. Akad. Wetens. Te Amsi. Proc. Sect. Sci.," Pt. II. 1917. **19**, 1275. Harvey—" J. Gen. Physiol.," 1922. **4**, 285; " J. Franklin Inst.," 1923, **196**, 31; " The Nature of Animal Light," Philadelphia, 1925.

(2) Hayasi and Okuyama—" Okayama Igaggai Zashi," 1929. 41, 185, 270.

(3) Warburg and Christian, " Biochem. Z.," 1932, 254, 438.

(4) Copisarow—" Nature," 1932. **130**, 1,001; " Protoplasma," 1934, **21**, 73; Maxia—" Protoplasma," 1935, **23**, 77.

(5) Warburg and Christian—" Biochem. Z.," 1933 **257**, 492.

(6) Gurwitsch—" Russ. J. Physiol.," 1933, **16**, 495.

Import Duties Act Inquiry, 1934

Statistical Summary for Chemical and Allied Trades

THE "Board of Trade Journal" has published, as a special supplement, Preliminary Report No. 11 of the Import Duties Act Inquiry, which covers trades concerned in the making of chemicals, dyestuffs, drugs, fertilisers, disinfectants, glue, oil and tallow, explosives, etc., of which a general summary is given below :—

Trade.		Gross output (selling value of goods made and value of work done).	Cost of materials used and amount paid for work given out.	Net output (excess of col. (2) over vol. (3)).	Average number of persons employed.	Net output per person employed.
(1)		(2)	(3)	(4)	(5)	(6)
		£'000	£'000	£'000	No.	£
Chemicals, Dyestuffs and Drugs	1934	62,707	28,981	32,996*	73,347	450
	1933	59,064	27,349	30,905*	68,335	452
Fertiliser, Disinfectant, Glue, etc. ..	1934	5,684	3,002	2,682	9,112	294
	1933	5,136	2,688	2,448	8,696	282
Soap, Candle and Perfumery	1934	25,368	12,162	13,206	28,139	469
	1933	25,314	13,216	12,098	26,680	453
Paint, Colour and Varnish	1934	19,747	10,261	9,486	23,289	407
	1933	17,851	9,179	8,672	21,991	394
Seed Crushing	1934	17,188	13,319	3,869	10,754	360
	1933	17,568	14,964	2,604	10,671	244
Oil and Tallow	1934	13,769	9,289	4,480	8,241	544
	1933	13,867	9,422	4,445	7,926	561
Explosives and Fireworks	1934	4,920	2,011	2,909	8,994	323
	1933	4,870	1,978	2,892	8,966	323
Starch and Polishes	1934	6,464	2,581	3,883	7,846	495
	1933	6,404	2,601	3,803	7,753	491
Ink, Gum and Typewriter Requisites ..	1934	3,608	1,469	2,139	4,416	484
	1933	3,214	1,300	1,914	4,089	468
Total	1934	159,455	83,075	75,650	174,138	434
	1933	153,288	82,697	69,781	165,107	423

* Exclusive of Excise duty estimated at £730,000 in 1934 and £810,000 in 1933.

Wood Preservation in India

A New Compound Discovered

For years past, experiments in wood preservation in India have been in progress at the Forest Research Institute, Dehra Dun, and as a result of these experiments a new compound has now been discovered to which the name "Ascu" is given. It is claimed that wood treated with "Ascu" can now seriously compete with concrete and steel in the construction of bridges, buildings and for electrical transmission and service lines.

The new compound is made by mixing copper sulphate and arsenic pentoxide with potassium dichromate, and remains fixed in the wood. The presence of potassium dichromate in some way prevents these preservatives from leaching out as happens when they are used alone. It is not yet known how permanent "Ascu" treated wood can be, but it is reasonable to suppose that it will last at least 25 years for exterior work, while for interior work it may last hundreds of years. The claim that "Ascu" is not leached out is supported by laboratory tests.

Another point in favour of the preservative is that the preservative tank is portable. Even poles up to 45 ft. long require only three sections of the steel cylinder transportable on three bullock carts. The next claim is that timber joints are now 60 per cent. stronger than when wood was bolted together, the method formerly employed. Now, rings are embedded in each member, while the bolt tying them goes through the middle. This distributes the sheer stresses which would ordinarily split the wood. The discovery allows members to be 40 per cent. lighter than formerly. It is further stated that wooden structures can be erected two and a half times as cheaply as concrete, while if bridges are erected in places where wood is easily available, economy in transport increases its relative cheapness. High wooden towers for wireless broadcasting, treated wooden trusses for halls and workshops, etc., are possibilities for this wood.

Grass Driers' Association

Grading of Dried Grass

A GRASS Driers' Association has been formed by twenty of the leading producers of dried grass in England, Scotland and Wales. The object of the Association is to arrange the marketing of the product, and one of its main aims, therefore, is to see that the purchasers obtain the particular quality of grass they require. For example, dairy farmers and stock-breeders need grass of the highest quality and richest in colouring matter and vitamins, which are necessary for producing "summer" quality milk in winter, and for keeping breeding stock and young animals in healthy condition. Other and lower grades of dried grass are suitable for horses, fattening cattle, sheep, etc. The Association has already met and agreed upon a grading schedule for dried grass, so that it is in a position to supply grass of any standard which may be demanded.

A large number of applications for membership have been received from individuals and firms connected with agricultural work, and it seems likely that, founded as it is on a voluntary basis by farmers who are producing mechanically-dried grass, it will develop into a useful marketing organisation. The present address of the Association is :— Grass Driers' Association, Billingham, County Durham. Anyone wishing to buy dried grass is therefore advised to get in touch with the Association for information regarding the grades available. It should be pointed out that the Association is an entirely independent organisation having no connection with Imperial Chemical Industries, Ltd., except its unofficial support.

THE imports into Argentina of soda ash rose from 22,735 metric tons in 1934 to 23,798 tons in 1935, of caustic soda from 13,138 to 14,834, sodium bicarbonate 1,615 to 2,102, and sodium silicate from 4,013 to 3,750 tons.

British Overseas Chemical Trade in June

According to the Board of Trade returns for the month ended June 30, 1936, exports of chemicals, drugs, dyes and colours were valued at £1,646,903, as compared with £1,556,316 for the corresponding month of 1935, showing an increase of £90,587. Imports were valued at £927,523, as compared with £805,566, an increase of £121,957. Re-exports were £29,182.

Imports

	Quantities. June 30, 1935.	Quantities. June 30, 1936.	Value. June 30, 1935.	Value. June 30, 1936.
Acids—				
Acetic .. .. cwt.	11,709	18,155	18,999	21,995
Boric (boracic) .. ,,	2,960	1,600	2,905	1,604
Citric .. .. ,,	662	1,634	2,676	6,467
Tartaric .. ,,	3,686	2,922	15,760	12,096
All other sorts .. value	—	—	5,126	8,316
Borax .. .. cwt.	12,900	19,725	6,471	11,178
Calcium carbide .. ,,	53,019	65,373	36,235	39,970
Fertilisers, manufactured—				
Superphosphate of lime tons	—	272	—	519
All other descriptions ,,	1,332	214	7,312	1,238
Phosphorus .. cwt.	2,889	356	7,888	1,574
Potassium compounds—				
Caustic and lyes cwt.	8,198	8,234	9,248	8,716
Chloride (muriate) ,,	44,720	49,902	13,575	15,252
Kainite and other mineral fertiliser salts cwt.	6,660	53,500	1,203	10,393
Nitrate (saltpetre) ,,	2,694	28,861	2,111	12,086
Sulphate .. ,,	30,751	22,200	10,798	10,643
All other compounds ,,	9,710	8,457	16,843	12,825
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	3,531	112	1,217	38
Chromate and bichromate .. .. cwt.	2,185	719	3,000	855
Cyanide .. ,,	1,000	8,829	2,677	21,292
Nitrate .. .. ,,	73,923	89,880	16,344	18,995
All other compounds ,,	19,753	21,606	15,948	19,830
Other chemical manumanufactures .. value	—	—	202,346	219,893
Drugs, medicines, etc.—				
Quinine and quinine salts .. oz.	87,547	101,325	7,282	8,871
Medicinal oils .. cwt.	3,257	5,159	9,355	13,150
Proprietary medicines value	—	—	49,337	32,366
All other sorts .. ,,	—	—	42,359	49,795
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar) .. .. cwt.	2,701	4,926	79,206	132,826
Extracts for dyeing ,,	3,796	4,881	8,236	10,861
Extracts for tanning (solid or liquid)—				
Chestnut .. cwt.	13,673	17,333	9,272	12,074
Quebracho .. ,,	36,990	11,497	22,161	10,043
All other sorts .. ,,	64,405	29,977	42,902	23,235
All other dyes and dyestuffs .. .. cwt.	673	893	15,444	19,751
Painters' colours and materials—				
White lead (basic carbonate) .. .. cwt.	6,816	8,423	7,823	11,110
Lithopone .. ,,	17,524	25,545	11,004	16,079
Ochres and earth colours cwt.	31,277	47,654	9,841	15,911
Bronze powders ,,	1,489	1,455	10,145	10,058
Carbon Black ,,	35,616	45,695	50,564	67,446
Other pigments and extenders .. cwt.	33,976	35,260	9,071	9,182
All other descriptions ,,	11,563	14,193	22,882	28,990
Total .. .. value	—	—	805,566	927,523

Exports

	Quantities. June 30, 1935.	Quantities. June 30, 1936.	Value. June 30, 1935.	Value. June 30, 1936.
Acids—				
Citric .. .. cwt.	2,241	2,356	9,430	10,346
All other sorts .. value	—	—	24,167	15,987
Aluminium compounds tons	1,791	1,610	13,829	11,068
Ammonium compounds—				
Sulphate .. ,,	20,196	20,604	119,797	121,372
All other sorts .. ,,	1,190	627	14,419	9,813
Bleaching powder (chloride of lime .. .. cwt.	36,146	48,525	10,179	12,987
Coal tar products—				
Cresylic acid .. gal.	116,633	176,115	9,500	19,592
Tar oil, creosote oil gal.	1,362,090	6,268,220	36,669	143,607
All other sorts .. value	—	—	9,581	22,571
Copper, sulphate of tons	4,657	4,646	62,902	63,871
Disinfectants, insecticides, weed killers .. ,,	23,882	24,255	47,873	55,824
Fertilisers, manufactured tons	8,698	8,626	37,149	35,993
Glycerine .. .. cwt.	8,488	7,767	22,220	19,359
Lead compounds .. ,,	15,451	10,518	17,615	14,504
Magnesium compounds tons	423	385	8,818	9,650
Potassium compounds cwt.	5,005	3,088	9,482	9,724
Salt (sodium chloride) tons	20,179	18,532	51,907	47,183
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	300,171	290,331	73,731	65,565
Caustic .. .. ,,	137,223	157,990	77,124	73,782
Nitrate .. .. ,,	11,416	7,641	3,929	2,483
Sulphate, including saltcake .. cwt.	34,066	43,798	3,091	3,929
All other sorts .. cwt.	59,023	54,251	69,407	63,209
Zinc oxide .. tons	855	1,145	15,793	20,655
All other descriptions value	—	—	188,338	189,505
Drugs, medicines, etc.—				
Quinine and quinine salts	199,366	71,975	20,722	8,836
Proprietary Medicines ,,	—	—	98,850	73,557
All other descriptions ,,	—	—	118,662	112,620
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs (coal tar)—				
Alizarine, alizarine red and indigo (synthetic) .. cwt.	1,352	2,123	7,413	13,968
Other sorts .. ,,	5,256	6,546	74,206	85,275
All other descriptions ,,	15,194	18,892	20,382	21,015
Painters' colours and materials—				
Ochres and earth colours cwt.	20,727	17,586	17,538	14,695
Other pigments and extenders .. cwt.	38,063	31,715	37,813	30,500
White lead .. ,,	5,498	5,483	10,429	11,464
Paints and painters' enamels, prepared or ready-mixed .. cwt.	35,626	39,450	93,619	102,960
Varnish and lacquer (clear) .. gal.	63,056	81,313	24,258	31,803
Printers' ink .. cwt.	5,110	5,121	29,031	24,867
All other descriptions ,,	34,385	36,478	66,393	72,744
Total .. .. value	—	—	1,556,316	1,646,903

Re-Exports

	Quantities. June 30, 1935.	Quantities. June 30, 1936.	Value. June 30, 1935.	Value. June 30, 1936.
Chemical manufactures products .. value	—	—	21,302	16,398
Drugs, medicines and medicinal preparations (Manufactured or prepared) .. .. value	—	—	10,426	10,645
Dyes and dyestuffs and extracts for tanning cwt.	393	347	488	1,074
Painters' colours and materials .. .. cwt.	873	637	1,505	1,065
Total .. .. value	—	—	33,721	29,182

Chemical Matters in Parliament

India: Quinine Supplies

IN the House of Commons on July 13, Sir Reginald Craddock asked the Under-Secretary of State for India whether he was aware of the shortage of quinine purchased by the Provincial Governments in India from the Government of India supplies, on account of which the Government of India were obliged to sell their surplus stocks at less than cost price, while the amount of quinine available in the Provinces was inadequate to the requirements of the country for coping with malaria; and what steps had been taken to remedy the deficiency of the supplies of quinine available in the various Provinces.

In reply, the Under-Secretary of State for India (Mr. Butler) said he had no very recent information and would ask for a report. Last year the Government of India gave 45,000 lb. of quinine to Provincial Governments for free distribution.

A New Fashion in Conferences

Success of the Advertising Cruise

THE convention cruise of the Advertising Association in the "Voltaire," led by Sir Ernest Benn, president of the Association, has proved a great success, not only in its social aspects but as a business conference. Among the many topics of vital interest discussed during the cruise were censorship, type and screen, sex appeal in advertising, and the lens versus the brush.

Responding to a warm welcome at Copenhagen, Sir Ernest Benn said the members of the Association came to Denmark honoured with a message of encouragement from King Edward VIII, who was good enough to express his keen personal interest in that endeavour, and out of his great experience in foreign travel to encourage them to think that their endeavour might be useful. The President of the Board of Trade, Mr. Walter Runciman, had also sent a message of goodwill. They had received charming encouragement from the Danish Government, its Ministers and its Royal House. Cruising, added Sir Ernest, was a habit only a few years old, and it was ripe for the introduction of new ideas. They believed they had introduced a new idea in undertaking this advertising convention cruise, and they hoped many trade and other associations would follow the pioneer lead of the Advertising Association by adopting the cruising conference idea. If that should be so, it would be welcome in their great shipping industry.

International trade, overseas business, was by universal consent the most urgent need of the world to-day. It was easy to talk in general terms of the world as a whole, but business men and women recognised that these general terms were nothing but the sum of all the little business transactions which must be carried through by individuals there and elsewhere.

Trade over most of the globe was discouraged by the shadow of war. Speaking for himself he had no belief in the possibilities of war. He held that the human race, at least in western Europe, had advanced beyond the stage when the horrors of war were possible. None of them in the wild talk that was about everywhere had ever heard a whisper of the possibility of war between Denmark and England. They had exhausted all their war-like necessities on one another in the past ten centuries, so they could work away to develop their trade full of confidence that whatever troubles might be ahead in connection with it, the great trouble of war between their nations need not even be taken into account.

They were under no delusion as to the complicated nature of overseas trade. The advertising profession knew perhaps more about the practical workings of commerce than the politicians. They knew that trade was sometimes bilateral, generally triangular and more often much more complicated.

Bromborough Margarine Works

Society of Chemical Industry's Visit

THE Bromborough margarine works, which were visited by members of the Society of Chemical Industry last week, were reorganised a few years ago so that "Stork" and other brands of margarine could be delivered with the maximum of efficiency to the whole of northern England and the Midlands. With such a product speed of delivery to the consumer is of the utmost importance, and every effort is made to ensure that margarine is received in the freshest possible condition.

The factory occupies some seven and a half acres of ground, with a frontage of nearly 1,300 ft., and represents a striking example of modern "straight-line" production. At one end of a quarter-mile chain of processes are the raw materials and at the other the packed margarine merges on railway platforms and a lorry loading park, whence a huge production is distributed every week.

The margarine was followed throughout every stage of its manufacture, beginning with the refining and purifying of the high quality vegetable oils which form the basis of the margarine. Visitors saw the various processes by which the oil is bleached, washed, filtered, and finally deodorised by a superheated steam and vacuum process, after which the oils are clear, bright and pleasant to the taste. Milk from Cheshire farms is used excusively and is pasteurised by a "Holding" process and then fermented to a material resembling buttermilk. Over 12,000 gallons of milk are used in this way every week.

The carefully blended oils and fermented milk are slowly agitated in large churns, the success of this operation depending on the temperature and the formation of the correct emulsion. Meanwhile, the valuable vitamins A and D are added. After chilling the emulsion on huge rotating and refrigerated rollers, the product, now in the form of flakes, undergoes a great deal of mechanical treatment in order to give it a butter-like texture.

Finally, the bulk margarine is moulded, cut, wrapped in automatic machines each turning out sixty packets per minute, and after packing into boxes is ready for despatch. Great care is taken to ensure freedom from impurity by conditioning the atmosphere and by cleanliness of the factory and the workers; the margarine is not touched by hand from start to finish.

A New Emulsifying Base

Properties of Trigamine

REPLACING triethanolamine in most cases, a new emulsifying base, trigamine, has just been introduced by the Glyco Products Co., Inc., New York, represented in Great Britain by Rex Campbell and Co., Ltd, 7 Idol Lane, E.C.3. Trigamine is a liquid, almost water-white in colour with a pleasant odour, is somewhat more viscous than triethanolamine and is completely soluble in water, glycols, glycerine and 50 per cent. alcohol. It is immiscible with organic solvents. It is non-hygroscopic at ordinary humidities and non-volatile up to 100° C. Trigamine forms soaps with the usual fatty acids, such as stearic and oleic. Such soaps do not darken or yellow with age. Trigamine stearate, for example, is a hard, white, wax-like solid which remains white over a long period of time. Trigamine cleate is a liquid and not gelatinous. Emulsions made with trigamine stearate are white and stable and do not discolour even on long standing. Trigamine is less alkaline than triethanolamine, a 10 per cent. solution in water having a *p*H of 9.7. Trigamine can be used as a dispersing agent for casein and shellac in water, replacing alkalies and giving a much more flexible film. Emulsions made with Trigamine are of interest in textiles, paper, leather, cosmetics, agricultural sprays, polishes and many other industries.

New Technical Books

ELEMENTARY PRACTICAL CHEMISTRY. By Arthur I. Vogel. Pp. 220. Blackie and Son, Ltd. 3s. net.

This book has been written specifically for elementary students in technical colleges and similar institutions, but it should also be suitable for secondary school and independent use. It provides a course of instruction in practical chemistry up to the matriculation standard, and gives a fairly comprehensive series of experiments in somewhat greater detail than usual. A brief description of the underlying theory is included to tell the student the real purpose of each experiment.

* * *

FLOUR MILLING PROCESSES. By J. H. Scott. Pp. 416 Chapman and Hall, Ltd. 21s. net.

Recent years have seen great developments in flour milling research. This book contains both theoretical and practical information and will be of great help to students of flour milling as well as practical millers. For the last twelve years the author has been on the staff of Henry Simon, Ltd., who are well-known as makers of flour milling machinery, and he has incorporated much engineering information which will be of interest to those who have problems of a "chemical engineering" nature. To cite one instance, there is an entire chapter devoted to the water cooling of rolls, and an appendix giving roll grinding data.

* * *

TECHNICAL DATA ON FUEL. Edited by H. M. Spiers. Fourth edition. Pp. 358. British National Committee, World Power Conference. 12s. 6d. net.

The first edition of this book was published in 1928 as a British contribution to a sectional meeting of the World Power Conference—the Fuel Conference—held in London in the autumn of that year. The book was so successful, and the demand so sustained that new editions were previously called for in 1930 and 1932. Data required in connection with fuel problems are presented with explanatory notes. The information covers a wide range, and includes relevant data on a variety of subjects connected with the domain of fuel technology. The data, some of which have not previously been published, have been arranged in the form of tables and charts to permit of their ready application. Recognised experts in various branches of industry have collaborated in the preparation of the volume.

* * *

A SHELLAC PATENT INDEX. By R. W. Aldis. Pp. 115. Indian Lac Research Institute, Ranchi, India. Rs. 2/8.

Increased activity in shellac research and many direct inquiries received by the Indian Lac Research Institute have disclosed the need for published information on the work which has already been done, and in particular concerning the patents which have been taken out on shellac during the last half century. It is in the hope that it may go some small way towards meeting this need that this collection of patent abstracts has been published. Some of the early patents are now of little more than historical importance, and many others show, unfortunately, that the inventors were not as familiar with the reactions and physical and chemical properties of shellac as they profess, and so undue importance must not be attached to their claims. The last chapter of the book has therefore been included to give readers a general idea of the nature and extent of the materials and processes claiming to substitute shellac or its uses. Some of the patents, however, are of interest from the point of view of shellac development since they give the shellac chemist some very good indications of the best ways of attacking his own various problems. In compiling the abstracts entirely from sources in the library of the Indian Lac Research Institute it has been realised that the information is not likely to be complete. It is therefore hoped that at some later date a search may be undertaken in more suitable situations and a comprehensive volume published.

ELEMENTARY QUALITATIVE ANALYSIS: Theory and Practice. By Hobart H. Willard and N. Howell Furman. Second edition. Pp. 436. Macmillan and Co., Ltd. 14s. net.

In this book the authors have endeavoured to include all of the theory and laboratory procedures required for the successful conduct of the student's first year's work in quantitative analysis. About one hundred additional problems have been added to those which appeared in the first edition published just two years ago. New material has been added to many chapters, that on the subject of neutralisation having been largely rewritten. A summary of the literature sources of qualitative analysis included in Chapter I, and numerous references to the original literature are given throughout the text in the hope that students may be encouraged to study certain methods in greater detail.

* * *

SALTS AND THEIR REACTIONS. By Leonard Dobbin and John E. Mackenzie. Sixth edition. Pp. 246. Edinburgh: E. and S. Livingstone. 6s. net.

This book had its origin as far back as 1889, when Professor A. Crum Brown compiled some notes on the reactions of a number of substances for use among his students of practical chemistry, each student being supplied with a leaflet detailing the work to be performed each day. Under the title "Notes on Reactions of Salts," these notes were published in several editions between 1889 and 1901. Later, they were extended by Dr. Dobbin and the late Professor Hugh Marshall, and with the addition of an introduction they were published under the present title in 1904. The book is divided into sections dealing with the nature and properties of salts, general methods of preparing salts, experiments on salt formation, reactions (metallic and acidic radicles), "dry-way" reactions, volumetric analysis, and examination of solid substances. There is also an appendix of experiments with some common organic substances.

* * *

PERFUMES, COSMETICS AND SOAPS, with especial reference to Synthetics. By William A. Poucher. Vol. I. Fourth edition. Pp. 439. Vol. II. Fifth edition, Pp. 426.

The perfumery industry never flags in its desire for information of the latest and most secret developments in its technique. These volumes, now accepted all over the world as the standard works of reference, owe their success to the revised and up-to-date matter they contain, together with the lucid explanations given to all branches of the business. Formerly they were issued in two volumes, but owing to the great increase in the size of the second volume, this has been again divided for convenience of reference, and the complete work will now cover three volumes. The first volume deals exclusively with raw materials for the whole industry, their sources, methods of production and purification; in the case of chemical bodies their synthesis with formulæ and physical constants. The best method of utilising them is clearly defined by the author, and in several instances he gives formulæ for their employment. For those readers who have little chemical knowledge, a concise explanation of the structure of synthetics is given in the appendix. The second volume is devoted entirely to perfumes of all types. All known methods of extracting flowers and aromatic substances are given in detail; odours are classified and the important question of fixation and blending discussed in its most modern aspect. The monographs on flower perfumes include all the important types from the points of view of history, botany, chemistry and practical perfume manufacture. Every synthetic which can be utilised is included, and many successful formulæ are appended. The difficult art of soap perfumery also receives detailed treatment, while many useful wrinkles are given to the tobacco chemist in the chapter on that subject. Other features are floral cachous, incense, fumigants, sachets, solid perfumes and fruit flavours. Volume II is also noteworthy for a detailed account of the rose industry, following the author's visit to Bulgaria.

FLAME. By Oliver C. de C. Ellis and William A. Kirkby. Pp. 106. Methuen and Co., Ltd. 3s. net.

This book offers a close analytical scrutiny of the conditions governing the ignition of such a flame, and its propagation thereafter. Combustion is examined from the aerodynamical aspect; from the chemical aspect, discussing such problems as equilibrium-shift under changing conditions of temperature and pressure, chain-reactions, the supture of the molecule into radicles and atoms; and from the physical aspect. The authors are associated with the Flame Section of the Safety in Mines Research Board.

* * *

TRIATHANOLAMINE UND ANDERE AETHANOLAMINE. By Emil J. Fischer. Pp. 84. Berlin. Allgemeiner Industrie-Verlag G.m.b.H. RM. 5.60.

Under the name of ethanolamines a series of aliphatic aminoalcohols headed by triethanolamine have made striking headway within the past decade in a number of important industries. Triethanolamine owes its popularity to a considerable extent to a unique combination of properties; resembling glycerine in many respects, it is much more hygroscopic and forms soap-like salts with many fatty acids which are soluble in mineral oils as well as in water. As typified by the linoleate, stearate and oleate, the soaps of triethanolamine are now recognised as first-rate emulsifying agents for vegetable, animal and mineral oils (although the discolouring tendency is a serious drawback in cosmetics) and as thickening agents for lubricating oils while their detergent action has not gone unnoticed. With its up-to-date survey of ethanolamine applications based upon the international periodical and patent literature, the monograph under review is thus of great topical interest and can be recommended to the attention of manufacturers and chemists engaged in the cosmetics, textile, lacquer and leather industries.

Production of Butanol

Molasses as Raw Material

MANY organisms have been suggested as suitable for the production of butanol from molasses on a commercial scale. In the current issue of "Facts about Sugar," Owen gives the results of large scale working using *Bacillus tetryl*, the bacteria discovered by Arroyo (U.S. Pat. 715,367). Instead of using sulphuric acid to convert the sucrose into fermentable hexoses, a "yeast autolysate" is used, which also provides the bacteria with adequate supplies of assimilable protein. The inversion of the sucrose is complete within an hour and the fermentation within thirty-six hours of the time of setting; 490 lb. of molasses yield 100 lb. of solvents consisting of 74.5 lb. of *N*-butanol, 20.5 lb. of acetone, and 5 lb. of ethyl alcohol. A comprehensive list of the industrial uses of butanol is given. It is pointed out that its most important application at present is for cellulose lacquers, and that one of the most promising developments for the future lies in its use as a stabiliser for alcohol-petrol blends of motor fuel, for which purpose it is used in quantities equal to 1 per cent. by volume of the blend.

Carbon Black in the United States

Summary of Operations in 1935

THE United States carbon black industry, which had made marked progress in 1934, enjoyed a profitable year in 1935, states the Bureau of Mines, Department of the Interior. Production was 352,749,000 lb., exceeded only by the totals of 1929 (366,442,000 lb.) and 1930 (379,924,000 lb.). Demand reached a new peak, the total of domestic and export sales being 387,536,000 lb., compared with the previous record of 374,468,000 lb. in 1933. Stocks at the plants were materially reduced in 1935, only 136,086,000 lb. or a little more than four months' supply being on hand December 31, compared with 171,799,000 lb. on hand at the beginning of the year. The increase in prices, which occurred about the beginning of 1934, was maintained in 1935, the average value at the plants being 3.90 cents, compared with 3.54 cents in 1934.

Some 241,589,000,000 cu. ft. of natural gas was burned in the manufacture of carbon black in 1935, compared with 229,033,000,000 cu. ft. in 1934. The 1935 figure was equivalent to about 13 per cent. of the total consumption of natural gas in that year. The average yield of carbon black in 1935 was 1.46 lb. per thousand cu. ft., compared with 1.43 lb. in 1934.

Exports of carbon black totalled 142,185,000 lb. in 1935, an increase of 18 per cent. over 1934. The United Kingdom continued to be the leading customer, but Germany displaced France in second place. The total value of carbon black exports in 1935 was $6,673,000, an average of 4.69 cents per lb., compared with an average of 4.59 cents in 1934.

Chemical News from Japan

Some Recent Developments

THE RAYON DEPARTMENT OF KUREHA BOSEKI K.K., of of Jinken-Bu, is now constructing a large viscose rayon factory at Miyazaki where a daily output of 50 to 60 tons is planned.

FOLLOWING SUCCESSFUL PRODUCTIONS of formaldehyde solution from ethylene in their experimental "corona discharge" plant, Nippon Seitetsu K.K. intend to adopt the process on a large scale at their Yahata works.

THE JAPANESE PATENT RIGHTS for the Fischer coal hydrogenation process have been purchased for 1.5 million yen by Mitsui Kozan K.K., who are drawing up plans for the initial installation.

A MAGNETIC ALLOY WITH REMARKABLE LIFTING POWER has been developed by the Japanese metallurgist, Honda, using certain proportions of titanium, nickel and cobalt ("Chemiker-Zeitung," May 23).

POTASSIUM PERMANGANATE IS NOW MANUFACTURED by Nippon Seiren Kaisha, who are just increasing their monthly production from 45 tons to 60 tons, and Nippon Soda K.K., with a monthly output of 15 tons.

TO INCREASE ITS PRODUCTION of magnesium chloride the Nippon Kiyu Kogyo K.K. ras recently increased its capital from 45,000 to 200,000 yen. The whole of the company's output of magnesium chloride lye is taken at present by Nichiman Magnesium K.K.

DEVELOPMENTS IN THE JAPANESE PERFUME INDUSTRY are reported in "Chemische Industrie." The new vanillin plant of Yoyogi Koryo K.K. is now operating with a monthly output of 3,400 kilos to be increased to 5,600 tons. It is also proposed to increase the ionone output. Another newcomer to the vanillin field is the Hogyoku Perfume Works with a contemplated monthly output of 500 kilos.

PRODUCTION OF FUMING SULPHURIC ACID has now commenced on a moderate scale at the Koyasu factory of Nippon Kali Kogyo K.K., manufacturers of sulphuric acid by the contact process. Another concern which has embarked upon sulphuric acid manufacture is the recently formed Nippon Ryusan K.K. (Japanese Sulphuric Acid Co.) with a proposed commencing daily output of 60 tons.

SEVERAL DEVELOPMENTS IN THE LIGHT METAL FIELD are reported in the "Chemische Industrie": Aluminium manufacture is to be undertaken by Nippon Soda K.K. at a plant with a commencing annual capacity of 2,400 tons in Takasku (Toyama Province). The capacity of the Ube factory of Nichi-Man Magnesium K.K. is to be increased to 800 tons per annum. Completion is now announced of the new magnesium plant (provisional output at the rate of 1,000 tons per annum) of Nippon Magnesium Kinzoku K.K.

Personal Notes

MR. JOHN L. GRIEVE, B.Sc., of Wilton Hill, Hawick, who recently graduated Doctor of Philosophy in Chemistry at Edinburgh University, has been appointed to the research laboratories of Imperial Chemical Industries, Ltd., at Manchester.

MR. THOMAS G. HARDIE, of Glasgow, coalmaster and shipowner, a director of John Hardie and Co., shipowners, Archibald Russell, Ltd., David Colville and Sons, the Polmaise Patent Fuel Co., the Carnlough Lime Co., and the Tharsis Sulphur and Copper Co., left personal estate valued at £71,174.

MR. ALEXANDER CHALMERS, aged 79, formerly works manager of the Scottish Acid and Alkali Co., Kilwinning, Ayrshire, died at Kilmarnock on July 10.

PROFESSOR C. O. BANNISTER, chairman of the Liverpool section of the Society of Chemical Industry, has been appointed Dean of the Faculty of Engineering at Liverpool University for the twelve months commencing September 1.

Mr. GUY FINLAYSON, Scotstoun, Glasgow, has secured an important appointment with the Kenital Gold Areas, Ltd., Kenya Colony, East Africa. During the war, Mr. Finlayson served with the gas section of the Royal Engineers in France. He has since held positions with metallurgical departments abroad. Mr. Finlayson is a member of the Works Management Association and of the British Association of Chemists, a graduate of the Institute of Chemical Engineers, and an associate of the Institute of Mining Metallurgy.

THE FOLLOWING AWARDS for the year 1936-7 have been made by the Salters' Institute of Industrial Chemistry and approved by the Court of the Salters' Company. Fellowships have been renewed to E. I. Akeroyd, of Emmanuel College, Cambridge, L. R. Barrett, of Lincoln College, Oxford, T. K. Hanson, of Oriel College, Oxford, and C. S. Windebank, of the University of London. Fellowships have been awarded to L. M. Baxt, of King's College, London, and T. A. Dent, of St. Catharine's College, Cambridge. The Salters' Institute has also awarded one hundred and fifty grants-in-aid to young men and women employed in chemical work to facilitate their further studies.

MR. M. C. LAMB, consulting chemist, has removed from 176 Tower Bridge Road, London, to 38 Poltimore Road, Guildford, Surrey (Telephone, Guildford 2012).

The widow of PROFESSOR WILLIAM RICHARD HODGKINSON, an authority on the chemistry of explosives, who died in 1935 at the age of 84, has been granted a Civil List Pension.

MR. JOHN R. PHILLIPS has been appointed general manager of S. Briggs and Co., Ltd., of Burton-on-Trent, and their associated company, Thornewill and Warham Successors.

PROFESSOR F. G. DONNAN, professor of chemistry at University College, London, has been elected a British honorary fellow of the Royal Society of Edinburgh. Among elections for foreign honorary fellows is Professor L. H. Baekeland, honorary professor of chemical engineering, Columbia University, New York.

MR. JOHN GWILLIAM MALTBY, of Newark, a chemist with the Distiller Co., Ltd., at their research department, Epsom, was married to Miss Rita Higgs Wilcox at Gloucester on June 30.

PROFESSOR JULIUS A. NIEUWLAND, professor of chemistry in Notre Dame University, United States, known for his work on synthetic rubber and notorious for devising poison gases for war uses, died on June 11, aged fifty-eight years.

THE FOLLOWING were elected to membership at a meeting of the board of the Institute of Physics on July 10. Fellows: R. Ablett, M.Sc., J. Chadwick, M.Sc., Ph.D., F.R.S., R. Guelke, Ph.D., W. Jackson, D.Sc., D.Phil., H. W. Paine, B.A., B.Sc., and H. J. Woods, B.A.; Associates: T. Emmerson, B.Sc., Ph.D., P. G. Gane, M.Sc., Ph.D., J. Tankard, M.Sc., R. S. Vincent, M.Sc., and E. E. Widdowson, M.Sc.; Students: G. R. D. Barnes, H. A. H. Boot, W.F. M. Dunne, G. E. F. Fertel, K. G. Gillard, J. Johnson, D. H. Landon, G. L. Lewis, P. A. Mayer, H. O. Puls, B. W. Ramsay, F. Scowen, J. B. Warren, G. A. Whitfield and A. E. Widdowson. Certificates in laboratory arts, awarded under the Institute's recently-introduced scheme for the proper certificating and training of laboratory and technical assistants in physics, have been granted to F. C. B. Daniels, E. A. Dew, G. R. Green, J. M. Leamy, R. W. Ridley, F. W. Ritchie, G. R. Rowe and H. E. Saffrey.

Continental Chemical Notes

Belgium

NEW MEDICINAL PRODUCTS, which were formerly imported, but are now manufactured by Union Chimique Belge, include remedies for sleeping sickness, malaria, dysentery, pernicious anæmia and diabetes. Other specialities of the concern are arsenic, antimony, calcium and gold salts.

Spain

THE COMPANIA ESPANOLA DE PETROLEOS S.A. is planning enlargement of its refinery on the Canary Isles, the annual capacity of which will be increased to 500,000 tons. In 1935 the concern made a net profit of 2½ million pesetas out of which it is proposed to distribute a dividend at the rate of 3 per cent.

France

THE NEWLY REGISTERED COMPANY, La Glyco-Sina, 18 rue de Lisbonne, Paris, is to acquire two patents owned by La Société Industrielle de Nouveaux Appareils. These are French Pat. Application Nos. 384,338 (extraction of glycerine from beet sugar liquors) and 399,892 (extraction of glycerine from distillery residues).

Roumania

WITH A CAPITAL OF 35 MILLION LEI, the Nitiomania S.A. has been formed by an influential group for the manufacture of nitric acid and other nitrogen compounds. By far the greatest proportion of the capital is in the hands of the Prima Societa Romana de Explosivi (29.75 million lei), the small balance being shared by Imperial Chemical Industries, Ltd., with 2.5 million lei and Dynamit Nobel, of Bratislava, with 1.3 million lei.

Italy

TIN REFINING AND THE PRODUCTION OF TIN SALTS will be undertaken at the new factory of Soc. An. Montemannu, Rome.

IMPORTANT DEVELOPMENTS IN THE ALUMINIUM INDUSTRY are revealed in the last list of "permits" for Italian war stores. The Borgofranco aluminium works of Soc. dell'Alluminio Italiano is to be enlarged, as is also the aluminium powder factory at Abbiategrasso of Soc. An. Italiano Fabbrichi Riunite Metalli in Fogli ed in Polvere. Finally, the Turin firm of Lorenzo Revelli is installing a plant for regeneration of scrap aluminium.

Estonia

A NEW FACTORY HAS BEEN STARTED by the firm of J. Maim, in Dorpat, where a variety of products will be made, including shoe polish, lubricants and glue.

Russia

AN ANNUAL PRODUCTION OF 15 TONS OF CADMIUM is estimated for the cadmium department of the Czeljabinsk zinc works which will commence operation at the end of this month.

AVIATION AND AUTOMOBILE SPIRIT are produced by the vapour phase cracking of petroleum fractions in a plant—the first of its type in the Soviet Union—recently installed at Constantinovka.

Czecho-Slovakia

THE 1935 TRADING YEAR of the Solo Match and Chemical Co., of Prague, closed with a net profit of 7.8 million kronen and a dividend of 22.5 kronen per share is being distributed. Good progress is reported to have been made in the department making waxed packing materials.

WITH THE COLLAPSE OF THE GLUE CARTEL in January of this year the Ossa A.G. für Chemische Industrie of Prague was compelled to curtail its activities. Foreign business friends of the concern, it is now reported in the "Chemische Industrie," are combining in an attempt to strengthen its position and it may consequently be possible to recommence production at the main factory in Prague-Vysocan.

From Week to Week

SUGAR REFINERIES AT GREENOCK have been working at normal rate for the season, although deliveries have been slow.

A SPECIAL PROCESS BUILDING is to be erected at the New Works, Beeston, for Boots Pure Drug Co., Ltd.

THE LIBRARY OF THE CHEMICAL SOCIETY will be closed for stocktaking from Monday, August 3, until Saturday, August 15, inclusive, and will close each evening at 5 o'clock from Monday, August 17, until Saturday, September 12.

A LARGE FIRE BROKE OUT at the Royal Dutch-Shell refinery, Willemstad, Netherlands East Indies. Three gasoline tanks were ablaze, but there were no casualties. Damage from the fire is estimated at Fl.2,000,000 (nearly £300,000).

ANDREW ROSS (32), a laboratory assistant, employed at a Government laboratory, was found dying in a taxicab at Westminster on July 7, from the effects of cyanide poisoning. A verdict of suicide while of unsound mind was returned at the inquest.

THE NOMINAL CAPITAL of Domo Remedies, Ltd., Empire House, 175 Piccadilly, W., has been increased by the addition of £9,900 beyond the registered capital of £100. The additional capital is divided into 39,750 preference shares of 4s. each and 39,000 founders shares of 1s. each.

THE DIRECTORS OF UNITED MOLASSES, LTD., announce that the entire outstanding balance of £102,419 4 per cent. funded income stock will be redeemed on August 31, 1936, in accordance with Clause 9 of the provisions of the instrument constituting the said stock. This stock was issued under the capital reconstruction scheme of February, 1934, to preference shareholders in satisfaction of arrears of dividend to September, 1933.

THE IMPORT DUTIES ADVISORY COMMITTEE has received an application for drawback under Section 9 of the Finance Act, 1932, in the case of unexposed sensitised photographic film in respect of duty payable under the Import Duties Act, 1932, on cellulose acetate photographic film base in rolls used in its manufacture. Representations should be addressed in writing to the Secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than July 25.

THE DISCOVERY THAT CERTAIN FOODS which go bad in sunlight are not affected by coloured light, so that milk may be preserved in brown glass bottles and fruit juices in green ones, was mentioned at a joint conference of the Food Group of the Society of Chemical Industry and the Royal Sanitary Institute at Southport, on July 9, by Mr. L. Davies, of the National Institute for Research in Dairying, Reading. He said the preserving of the fat and aroma of foods by storage in coloured glass containers had been extensively studied, and it had been found that blue and invisible ultra-violet light accelerated the development of rancidity, whereas other visible light, such as green, yellow, and red, had very little effect.

NEW BUILDINGS ARE BEING ERECTED AT PORT COLBORNE, Ontario, Canada, in connection with the increase of nickel refining capacity. Capital expenditure by the company this year at Sudbury and Port Colborne is likely to reach a total of $12,000,000, and the expansion of operations at Port Colborne will represent an increase of 43 per cent. in the capacity of the plant. The company's refining capacity for nickel in Canada and Great Britain will be brought up to approximately 200,000,000 lb. annually by the end of the year when enlarged smelting capacity at Copper Cliff will be completed and greater use will be made of the ore from the Creighton Mine. This contemplated total of 200,000,000 lb. compares with last year's record nickel sales of 129,000,000 lb., and is evidence of the preparations being made by the company to meet the world's enlarging demands for nickel.

SCOTTISH DYES, LTD., are to erect a gymnasium costing £1,500, and three extensions to their existing warehouses will cost £4,000.

BEAUTY PROPRIETARIES, LTD., Jermyn Street, London, have increased their nominal capital by the addition of £9,250 in £1 ordinary shares beyond the registered capital of £750.

FIRE BROKE OUT at the National Glass Works in Fishergate, York, on the night of July 13. The fire brigade found that the roof of the building was affected and the flames were spreading rapidly among the steel girders of the roof.

BUTNER AND EARLE, LTD., dealers in toilet preparations, etc., Astor House, Aldwych, have increased their nominal capital by the addition of £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

THE SPECIAL OFFER to members of the Chemical Engineering Congress of the World Power Conference to purchase the Transactions of the Chemical Engineering Congress, complete in four volumes with index volume, at the special price of £8 net, will close on August 15.

EMPLOYEES OF J. J. HADFIELD, LTD., Garrison bleach and dyeworks, New Mills, and Forge bleachworks, Chinley, Derbyshire, had their annual outing on July 4, a visit being made to Scarborough. The firm chartered a special train for the 500 employees attending the outing.

A FURTHER STEP TOWARDS THE GOVERNMENT'S SCHEME for the beet sugar industry, which provides for the amalgamation of the existing companies, was taken on July 9, when the shareholders of the Anglo-Dutch group of companies passed resolutions for winding-up voluntarily. The companies concerned were: The English Beet Sugar Corporation, the Ely Beet Sugar Factory, the Ipswich Beet Sugar Factory, and the King's Lynn Beet Sugar Factory.

THERE WERE 112 FURNACES IN BLAST at the end of June, three having been blown in and three put out of operation during the month. The production of pig iron in June amounted to 644,100 tons, compared with 661,000 tons in May, and 529,300 tons in June, 1935. The month's production includes 154,200 tons of hematite, 354,500 tons of basic, 109,800 tons of foundry and 10,500 tons of forge pig iron. The production of steel ingots and castings in June amounted to 965,900 tons, compared with 963,000 tons in May, and 770,000 tons in June, 1935.

WILLIAM JACKS AND CO., Winchester House, Old Broad Street, London, have undertaken the sales agency for Europe and the East of the Chromium Mining and Smelting Corporation, Ltd., of Hamilton, Ontario, manufacturers of high grade ferro-silicon (45/50 per cent., 75 per cent. and upwards), and also of ferro-chrome and silico-manganese. Canadian ferro-silicon has already been shipped to European ports, and the production is now on a much bigger scale. Owing to cheaper water-power and favourable sources of ore, the works are able to compete successfully with the Scandinavian makers.

FACTORIES AND FACTORY SITES AT WELWYN GARDEN CITY are discussed in a new leaflet which has been issued by Welwyn Garden City, Ltd. Welwyn is situated 21 miles north of London, outside the fog belt, free from traffic congestion and on the main L.N.E.R. line, running between London (King's Cross) the North of England and Scotland. A new goods depot with modern handling appliances has recently been constructed to deal with the ever-increasing traffic received and forwarded by the industrial firms on the factory estate. The position of Welwyn Garden City on the main L.N.E.R. line enables local firms to have the advantage of express goods train services to and from London, the Thames Docks, the Midlands, the North of England and Scotland, also the Continent via the Harwich-Zeebrugge train ferry. These services enable a next day delivery to be effected in the majority of the principal industrial towns of the country.

Weekly Prices of British Chemical Products

THERE are no price changes to report in the general market for heavy chemicals, rubber chemicals, wood distillation products, perfumery chemicals, essential oils and intermediates. In the coal tar products section there has been a reduction of a shilling per ton in the price of medium soft pitch, and in the pharmaceutical and photographic materials section the price of sodium salicylate has been reduced by threepence per pound. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

Price Changes

Coal Tar Products.—PITCH, medium, soft, 35s. to 36s. per ton.

Pharmaceutical and Photographic Materials.—QUININE SULPHATE, 2s. 2d. per oz. SODIUM SALICYLATE, powder, 1s. 5d. to 2s. 3d. per lb.; crystal, 1s. 5d. to 2s. 3d. per lb.

MANCHESTER.—With one or two exceptions steady price conditions continue to be reported on the Manchester chemical market this week, the exceptions being principally in the coal tar products section, where price changes are somewhat irregular, although for the most part quotations are maintained at or around their recent levels. The holiday season is making itself felt more and more, both in the attendance of buyers on the chemical market on the Royal Exchange here and on the quantities covered by delivery specifications. Allowing for this factor, however, trading conditions are generally satisfactory, and in the textile industries both in Lancashire and the West Riding of Yorkshire fair quantities of chemical products are moving into consumption. At the moment, fresh buying of any consequence is on a somewhat restricted scale, the majority of users being content to draw against existing contracts.

GLASGOW.—Business in chemicals has been rather quiet during the week, both for home trade and export. Prices, however, continue quite steady at about previous figures, with only slight changes to report.

In the coal tar products market there are few new commitments this week for July delivery, on account of the approaching annual holiday. A brisk demand for cresylic and carbolic acids continues, although there is less activity in the higher boiling fractions, poorer grades of which are available at a price comparable with ordinary dark 97/99%. There is not much movement in creosote, and a slackening in price of washed oils seems probable. Naphthalene is very scarce: the price £7 to £8 is nominal. Pyridine 90% 140 is difficult to obtain for prompt delivery: 90% 160 is in demand whenever available: 90% 180 and heavier grades remain uninteresting at 2s. 6d.

General Chemicals

ACETONE.—LONDON: £62 to £65 per ton; SCOTLAND: £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—40% technical, £16 12s. 6d. per ton. LONDON: Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £48 to £50.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, £28; powdered, £29.

ACID, CHROMIC.—Flaked, 10d. per lb., less 2½%; ground, 10¼d. per lb., less 2½%, d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 1s. SCOTLAND: B.P. crystals, 1s. per lb. less 5%.

ACID, CRESYLIC.—97/100%, 1s. 5d. to 1s. 6d. per gal.; 99/100%, refined, 1s. 9d. to 1s. 10d. per gal. LONDON: 98/100%, 1s. 5d. f.o.r.; dark, 1s.

ACID, FORMIC.—LONDON: £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—LONDON: £47 17s. 6d. to £57 10s. per ton, according to packages and position. SCOTLAND: £2 10s. per cwt. in casks. MANCHESTER: £49 to £55 per ton ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—1s. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. LONDON: 11¼d., less 5%. SCOTLAND: 11¾d. less 5%. MANCHESTER: 1s. per lb.

ALUM.—SCOTLAND: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19 (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality, 20.6% nitrogen, £7 per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ANTIMONY SULPHIDE.—Golden, 6½d. to 1s. 1d. per lb.; crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £18 ex store. MANCHESTER: White powdered Cornish £21 10s. ex store.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARIUM CHLORIDE.—LONDON: £10 10s. per ton. SCOTLAND: £11.

BARYTES.—£6 10s. to £8 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.r. London.

BLEACHING POWDER.—Spot, 35/37%, £7 19s. per ton d/d station in casks, special terms for contract. SCOTLAND: £9.

BORAX, COMMERCIAL.—Granulated, £14 10s. per ton; crystal, £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots. SCOTLAND: Granulated, £14 10s. per ton in 1 cwt. bags, carriage paid.

CADMIUM SULPHIDE.—3s. 10d. to 4s. 1d. per lb.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. SCOTLAND: £5 10s. per ton net ex store.

CARBON BISULPHIDE.—£31 to £33 per ton, drums extra.

CARBON BLACK.—3¾d. to 4¾d. per lb. LONDON: 4½d. to 5d.

CARBON TETRACHLORIDE.—SCOTLAND: £41 to £43 per ton, drums extra.

CHROMIUM OXIDE.—10¾d. per lb., according to quantity d/d U.K.; green, 1s. 2d. per lb.

CHROMETAN.—Crystals, 2¾d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 18s. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40%, £25 to £28 ex store.

IODINE.—Resublimed B.P., 6s. 3d. to 8s. 4d. per lb.

LAMPBLACK.—£26 to £28 per ton.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £34, brown £33.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £31 per ton less 2½%, carriage paid.

LEAD, WHITE.—SCOTLAND: £39 per ton, carriage paid. LONDON: £41.

LITHOPONE.—30%, £16 5s. to £16 10s. per ton.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £6 17s. 6d. per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

PHENOL.—6¾d. to 7½d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39.

POTASSIUM BICHROMATE.—Crystals and Granular, 5d. per lb. less 5%, d/d U.K. Ground, 5¼d. LONDON: 5d. per lb. less 5%, with discounts for contracts. SCOTLAND: 5d. per lb. less 5% carriage paid. MANCHESTER: 5d.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 4¼d. per lb. MANCHESTER: £38 per ton.

POTASSIUM CHROMATE.—6¼d. per lb. d/d U.K.

POTASSIUM IODIDE.—B.P., 5s. 2d. per lb.

POTASSIUM NITRATE.—SCOTLAND: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 8½d. per lb. SCOTLAND: B.P. crystals, 8¾d. MANCHESTER: B.P., 11¼d.

POTASSIUM PRUSSIATE.—LONDON: Yellow, 7½d. to 8d. per lb. SCOTLAND: 7½d. net, ex store. MANCHESTER: Yellow, 8¼d. to 8½d.

SALAMMONIAC.—First lump spot, £41 17s. 6d. per ton d/d in barrels. SCOTLAND: Large crystals, in casks, £36.

SODA ASH.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. SCOTLAND: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. MANCHESTER: £13 5s. to £14 contracts.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—LONDON: £21 per ton. SCOTLAND: £17 15s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags. SCOTLAND: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. MANCHESTER: £10 10s.

SODIUM BICHROMATE.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. LONDON: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. MANCHESTER: 4d. per lb. SCOTLAND: 4d., less 5% carriage paid.

SODIUM BISULPHITE POWDER.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.

SODIUM CARBONATE, MONOHYDRATE.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, SCOTLAND: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.

SODIUM CHLORATE.—£29 per ton. SCOTLAND: £1 10s. per cwt.

SODIUM CHROMATE.—4d. per lb. d/d U.K.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 12s. 6d. per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANLHESTER: £3 2s. 6d. to £3 5s.

SODIUM SULPHIDE.—Solid 60/62% Spot, £10 15s. per ton d/d in drums; crystals 30/32%, £8 per ton d/d in casks. SCOTLAND: For home consumption, Solid 60/62%, £10 5s.; broken 60/62%, £11 5s.; crystals, 30/32%, £8 7s. 6d., d/d buyer's works on contract, min. 4-ton lots. Spot solid, 5s. per ton extra. Crystals, 2s. 6d. per ton extra. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8.

SODIUM HYPOSULPHITE.—SCOTLAND: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. MANCHESTER: Commercial, £10 5s.; photographic, £14 10s.

SODIUM METASILICATE.—£14 per ton, d/d U.K. in cwt. bags.

SODIUM IODIDE.—B.P., 6s. per lb.

SODIUM NITRITE.—LONDON: Spot, £18 5s. to £20 5s. per ton d/d station in drums.

SODIUM PERBORATE.—10%, 9¼d. per lb. d/d in 1-cwt. drums. LONDON: 10d. per lb.

SODIUM PHOSPHATE.—£13 per ton.

SODIUM PRUSSIATE.—LONDON: 5d. to 5¼d. per lb. SCOTLAND: 5d. to 5¾d. ex store. MANCHESTER: 5d. to 5¼d.

SODIUM SILICATE.—140° Tw. Spot, £8 per ton. SCOTLAND: £8 10s.

SODIUM SULPHATE (GLAUBER SALTS).—£4 2s. 6d. per ton d/d SCOTLAND: English material, £3 15s.

Coal Tar Products

ACID, CRESYLIC.—97/99%, 2s. 6d. to 2s. 7d. per gal.; 99/100%, 3s. to 3s. 6d. per gal., according to specification; pale 98%, 2s. 9d. to 2s. 10d.; dark, 2s. to 2s. 1d. LONDON: 98/100%, 1s. 4d.; dark, 95/97%, 1s. GLASGOW: Pale, 99/100%, 2s. 6d. to 2s. 9d. per gal.; pale, 97/99%, 2s. 2d. to 2s. 4d.; dark, 97/99%, 2s. to 2s. 1d.; high boiling acids, 2s. to 2s. 6d.; American specification, 2s. 6d. to 2s. 9d.

ACID, CARBOLIC.—Crystals, 6¾d. to 7½d. per lb.; crude, 60's, 2s. 3d. to 2s. 6d. per gal. MANCHESTER: Crystals, 6¾d. per lb.; crude, 2s. 6d. per gal. GLASGOW: Crude, 60's, 2s. 4d. to 2s. 6d. per gal.; distilled, 60's, 2s. 8d. to 3s.

BENZOL.—At works, crude, 8¼d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. LONDON: Motor, 1s. 3½d. GLASGOW: Crude, 8½d. to 9d. per gal.; motor, 1s. 3d. to 1s. 4d.

CREOSOTE.—B.S.I. Specification standard, 5½d. per gal. f.o.r. Home, 3¾d. d/d. LONDON: 4½d. f.o.r. North; 5d. London. MANCHESTER: 4½d. to 5½d. GLASGOW: B.S.I. Specification, 5½d. to 5¾d. per gal.; washed oil, 5d. to 5¼d.; lower sp. gr. oils, 4¾d. to 5d.

NAPHTHA.—Solvent, 90/100%, 1s. 5½d. to 1s. 6½d. per gal.; 95/160%, 1s. 8d.; 90%, 1s. to 1s. 2d. LONDON: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. GLASGOW: Crude, 5½d. to 6d. per gal.; 90% 160, 1s. 4d. to 1s. 5d.; 90% 190, 1s. to 1s. 1d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £17 10s. per ton; purified crystals, £25 per ton in 2-cwt. bags. LONDON: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. GLASGOW: Fire lighter, crude, £7 to £8 per ton (bags free).

PYRIDINE.—90/140%, 5s. to 7s. per gal.; 90/180, 2s. 3d. GLASGOW: 90% 140, 6s. to 6s. 6d. per gal.; 90% 160, 5s. to 5s. 6d.; 90% 180, 2s. 6d.

TOLUOL.—90%, 2s. per gal.; pure, 2s. 4d. GLASGOW: 90% 120, 1s. 11d. to 2s. per gal.

XYLOL.—Commercial, 2s. 1d. per gal.; pure, 2s. 3d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

PITCH.—Medium, soft, 35s. to 36s. per ton, in bulk at makers works. MANCHESTER: 32s. 6d. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 32s. 6d. to 35s. per ton; in bulk for home trade, 32s. 6d.

Nitrogen Fertilisers

SULPHATE OF AMMONIA.—July, £7 5s. per ton; August, £6 14s. 6d.; September, £6 16s.; October, £6 17s. 6d.; November, £6 19s.; December, £7 0s. 6d. for neutral quality basis 20.6% nitrogen delivered in 6-ton lots to farmer's nearest station.

CALCIUM CYANAMIDE.—Prices for July/December have not yet been announced, but they are likely to be in line with last year's prices.

NITRO-CHALK.—£7 5s. per ton to end of September.

CONCENTRATED COMPLETE AND AMMONIUM PHOSPHATE FERTILISERS. Prices have not yet been fixed and at present it is impossible to give any indication as to the date of any announcement or of the trend of prices.

Wood Distillation Products

ACETATE OF LIME.—Brown, £8 to £8 10s. per ton; grey, £10 5s. to £10 15s. Liquor, brown, 30° Tw., 8d. per gal. MANCHESTER: Brown, £9 10s.; grey, £10 10s.

CHARCOAL.—£5 to £10 per ton, according to grade and locality.

METHYL ACETONE.—40-50%, £45 to £48 per ton.

WOOD CREOSOTE.—Unrefined 6d. to 1s. 6d. per gal., according to boiling range.

WOOD, NAPHTHA, MISCIBLE.—2s. 9d. to 3s. 3d. per gal.; solvent, 3s. 9d. per gal.

WOOD TAR.—£2 to £2 10s. per ton.

Intermediates and Dyes

ACID, BENZOIC, 1914 B.P. (ex Toluol).—1s. 9½d. per lb.

ACID, GAMMA.—Spot, 4s. per lb. 100% d/d buyer's works.

ACID, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.

ACID NAPHTHIONIC.—1s. 8d. per lb.

ACID, NEVILLE AND WINTHER.—Spot, 3s. per lb. 100%.

ACID, SULPHANILIC.—Spot, 8d. per lb. 100%, d/d buyer's works.

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

o-CRESOL 30/31° C.—6d. per lb. in 1-ton lots.

p-CRESOL 34-5° C.—1s. 6d. per lb. in ton lots.

m-CRESOL 98/100%.—1s. 7d. per lb. in ton lots.

DICHLORANILINE.—1s. 11½d. to 2s. 3d. per lb.

DIMETHYLANILINE.—Spot, 1s. 6d. per lb., package extra.

DINITROBENZENE.—8d. per lb.

DINITROTOLUENE.—48/50° C., 9d. per lb.; 66/68° C., 10½d.

DINITROCHLORBENZENE, SOLID.—£72 per ton.

DIPHENYLAMINE.—Spot, 2s. per lb., d/d buyer's works.

α-NAPHTHOL.—Spot, 2s. 4d. per lb., d/d buyer's works.

β-NAPHTHOL.—In bags, £88 15s. per ton; in casks, £89 15s.

α-NAPHTHYLAMINE.—Lumps, 1s. per lb.; ground, 1s. 0½d.

β-NAPHTHYLAMINE.—Spot, 2s. 9d. per lb., d/d buyer's works.

o-NITRANILINE.—3s. 11d. per lb.

m-NITRANILINE.—Spot, 2s. 7d. per lb., d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 8d. per lb., d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb.; 5-cwt. lots, drums extra.

NITRONAPHTHALENE.—9d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 9d. per lb.

o-TOLUIDINE.—9½d. to 11d. per lb.

p-TOLUIDINE.—1s. 11d. per lb.

Latest Oil Prices

LONDON, July 15.—LINSEED OIL was closed steadier. Spot, £28 15s. (small quantities), July £26 2s. 6d.; Aug. and Sept.-Dec., £26 5s.; Jan.-April, £25 17s. 6d., naked. SOYA BEAN OIL was quiet. Oriental (bulk), spot, Rotterdam, £24. RAPE OIL was steady. Crude, extracted, £34 10s.; technical refined, £35 10s., naked, ex wharf. COTTON OIL was steady. Egyptian, crude, £26 10s.; refined common edible, £30; and deodorised, £32., naked, ex mill (small lots £1 10s. extra). TURPENTINE was steady. American, spot, 39s. 3d. per cwt.

HULL, July 15.—LINSEED OIL.—Spot, quoted £27 5s. per ton. July £27, Aug. £26 12s. 6d., Sept.-Dec. £26 5s., Jan.-April £25 17s. 6d. COTTON OIL.—Egyptian, crude spot, £26 10s.; edible, refined, spot, £28 10s.; technical, spot, £28 10s.; deodorised, £30 10s., naked. PALM KERNEL OIL.—Crude, f.m.q., spot, £22. GROUNDNUT OIL.—Extracted, spot, £32 10s.; deodorised, £35 10s. RAPE OIL.—Extracted, spot, £33 10s.; refined, £34 10s. SOYA OIL.—Extracted, spot, £28 10s.; deodorised, £31 10s. per ton. COD OIL.—F.o.r., 25s. per cwt., in barrels. CASTOR OIL.—Pharmaceutical, 42s. 6d. per cwt.; firsts, 37s. 6d., seconds, 35s. 6d. TURPENTINE.—American, spot, 42s. 6d. per cwt.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

POLYMERIZATION OF VINYL COMPOUNDS.—Röhm and Haas, A.-G. December 31, 1934. 32915/35.

SEPARATION OF ANTIMONY from alloys containing lead and/or tin as principal ingredients, along with antimony. American Metal Co., Ltd. January 5, 1935. 35451/35.

SYNTHETIC HYDROCARBON OILS and process of producing same.—Standard Oil Co. of California. December 31, 1934. 35960/35.

FRACTIONAL CONDENSATION and/or distillation of hydrocarbon oils.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. Jan. 4, 1935. 36094/35.

PRODUCTION OF LITHARGE OR RED LEAD.—E. Barthelmess. Jan. 4, 1935. 110/36.

MANUFACTURE OF NITRATES.—H. Pauling. Jan. 2, 1935. 203/36.

CLARIFYING WATER.—Maschinenfabrik Buckau R. Wolf, A.-G. Jan. 3, 1935. 289/36.

PRINTING VEGETABLE FIBRE.—Soc. of Chemical Industry in Basle. Jan. 5, 1935. 473/36.

Applications for Patents

(July 2 to 8 inclusive.)

PRODUCTION OF PROTEIN PLASTICS.—D. K. Baird. 18877.

PREPARATION OF SUBSTITUTED URETHANES, etc.—H. Barnes. 18571.

RESINOUS CONDENSATION PRODUCTS.—Beck, Koller and Co. (England), Ltd. (United States, July 6, '35). 18744.

DRESSING, ETC., FABRICS.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 18387.

SYNTHETIC RESINS.—British Celanese, Ltd. (United States, July 6, '35). 18462.

POLYENE CARBOXYLIC ACIDS.—A. Carpmael (I. G. Farbenindustrie). 18429.

CONDENSATION PRODUCTS.—A. Carpmael (I. G. Farbenindustrie). 18540.

PROCESS OF PRESERVING GREEN FODDER.—A. Carpmael (I. G. Farbenindustrie). 18978.

CONDENSATION PRODUCTS OF PHENANTHRENE SERIES.—A. Carpmael (I. G. Farbenindustrie). 18979.

MANUFACTURE OF ORGANIC COMPOUNDS.—H. Dreyfus. 18356.

MANUFACTURE OF ORGANIC SUBSTANCES.—H. Dreyfus. 18461.

MANUFACTURE OF WATER-SOLUBLE DERIVATIVES of heterocyclic series.—J. R. Geigy, A.-G. (Switzerland, May 14). 18502.

PROCESS FOR TREATING LEATHER, ETC.—W. W. Groves (I. G. Farbenindustrie). Jan. 21. 18506.

MANUFACTURE OF ORGANIC COMPOUNDS from acetone, etc.—D. V. N. Hardy. 18330.

HYDROGEN ESTER SALTS.—I. G. Farbenindustrie. (Germany, July 3, '35.) 18504.

CARBOXYLIC ACID AMIDES.—I. G. Farbenindustrie and G. W. Johnson. 18938.

APPARATUS FOR GRINDING, etc., solid materials.—Imperial Chemical Industries, Ltd. 18428.

APPARATUS FOR HIGH-VACUUM DISTILLATION.—Imperial Chemical Industries, Ltd. 18578.

MANUFACTURE OF CHARGES, etc., for generation of gas pressures—Imperial Chemical Industries, Ltd. 18779.

VACUUM-TIGHT JOINTS.—Imperial Chemical Industries, Ltd. 18780.

TREATMENT OF PROTEIN PLASTICS.—Imperial Chemical Industries, Ltd., and R. E. Slade. 18877.

PRODUCTION OF SOAPS.—G. W. Johnson (I. G. Farbenindustrie). 18386.

PRODUCTION OF SULPHUR.—G. W. Johnson (I. G. Farbenindustrie). 18702.

MANUFACTURE OF PULVERULENT PRODUCTS.—G. W. Johnson (I. G. Farbenindustrie). 18937.

PURIFICATION OF NATURAL ORGANIC PRODUCTS.—Kodak, Ltd. (United States, July 10, '35.) 18439.

MANUFACTURE OF DYES.—Kodak, Ltd. (United States, July 5, '35). 18756.

PREPARATION OF VITAMIN D.—Kodak, Ltd. 18758.

PROCESS OF VACUUM DISTILLATION.—Kodak, Ltd. 18759, 18760.

METHOD OF DISTILLING large quantities of liquid.—Kodak, Ltd. 18761.

APPARATUS FOR PRODUCING HIGH VACUUM.—Kodak, Ltd. 18762.

PRODUCTIONS OF SYNTHETIC RESINS, etc.—Kodak, Ltd. 18987, 18988.

PRODUCING GAS for synthesis of hydrocarbons.—H. Koppers' Industrieele Maatschappij N.V. (Germany, July 3, '35.) 18496.

PRODUCING GAS for synthesis of hydrocarbons. H. Koppers' Industrieele Maatschappij N.V. (Germany, Aug. 2, '35.) 18497, 18498.

PROCESS FOR OBTAINING pure mixture of carbon monoxide and hydrogen.—T. Lichtenberger. 18670.

PRODUCTION OF MAGNESIUM, ETC.—Magall A.-G. (Austria, Sept. 27, '35.) 18695.

THERAPEUTICALLY-USEFUL ORGANIC COMPOUNDS.—May and Baker, Ltd. 18643.

PRODUCTION OF SALTS of low water content.—Metallges, A.-G. (Germany, July 6, '35.) 18421.

PRODUCTION OF OLEFINES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, July 15, '35). 18417.

SUBSTITUTED URETHANES.—F. L. Pyman. 18571.

APPARATUS FOR DISTILLATION of solid carbonizable materials.—E. M. Salerni (Soc. d'Etudes et de Valorization Industrielle des Combustibles). 18501.

COMPOSITION FUEL.—A. Vloeberghs. 18389.

Specifications Accepted with Date of Application

PHOTOGRAPHIC SILVER HALIDE EMULSIONS.—Kodak, Ltd. (Eastman Kodak Co.). Sept. 20, 1934. 449,527.

CATALYSTS FOR LIQUID AND VAPOUR PHASE HYDROGENATION PROCESSES, ammonia and methanol synthesis processes, and other industrial purposes.—H. P. Stephenson. Oct. 31, 1934. 449,603.

SOAP PRODUCTS and methods of making the same.—Swift and Co. December 21, 1933. 449,683.

PROTECTION OF METALLIC SURFACES against corrosion.—H. Sutton and L. F. Le Brocq. Dec. 3, 1934. 449,804.

WETTING, WASHING, CLEANSING, EMULSIFYING, DISPERSING, and like capillary-active agents.—W. J. Tennant (Henkel and Cie, Ges.). Dec. 21, 1934. 449,607.

CARBOXYLIC ACIDS and their salts.—Imperial Chemical Industries, Ltd. Aug. 27, 1934. 449,534.

HALOGEN-AMINO-1.9-ANTHRAPYRIMIDINES.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). Dec. 24, 1934. 449,537.

HALOGEN-AMINO-1.9-ANTHRAPYRIMIDINES.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie). Dec. 27, 1934. 449,611.

TREATMENT OF SOLUTIONS OF CHLORINATED RUBBER.—J. P. Baxter, T. N. Montgomery, J. G. Moore, and Imperial Chemical Industries, Ltd. Dec. 27, 1934. 449,542.

DYEING.—Imperial Chemical Industries, Ltd., and H. D. Mudford. Dec. 27, 1934. 449,543.

AGENTS OF CAPILLARY ACTIVITY.—W. W. Groves (I. G. Farbenindustrie). Dec. 28, 1934. 449,865.

DISTILLING AND COKING MIXTURES of solid carbonaceous materials and hydrocarbon oils.—N. Consitt, J. Smith, and R. E. Cowell. Dec. 31, 1934. 449,619.

SOLIDIFICATION OF MOLTEN MATERIALS.—Imperial Chemical Industries, Ltd. Dec. 30, 1933. 449,620.

PHTHALIC ANHYDRIDE RECOVERY.—National Aniline and Chemical Co., Inc. Dec. 29, 1933. 449,621.

CRACKING AND COKING HYDROCARBON OILS OR TARS and mixtures thereof with coal.—H. A. Brassert and Co., Ltd., and A. Fisher. Jan. 1, 1935. 449,870.

PRODUCTION OF ALKYLENE OXIDES.—H. Dreyfus. Jan. 3, 1935. 449,875.

COLOURING PAPER and similar products derived from paper pulp.—Imperial Chemical Industries, Ltd., P. T. Gale, F. Hamilton, and B. H. Livesley. Jan. 3, 1935. 449,805.

COMPOUNDED HYDROCARBON LUBRICATING OILS and greases.—R. W. Asprey. March 24, 1934. 449,779.

CONVERSION OF CARBON DISULPHIDE TO SULPHUR.—Gas Light and Coke Co., and R. H. Griffith. April 5, 1935. 449,710.

VULCANISING RUBBER.—Wingfoot Corporation. Sept. 27, 1934. 449,641.

TREATMENT OF HYDROCARBON MATERIAL with light hydrocarbons.—Standard Oil Development Co. Sept. 7, 1934. 449,717.

REFINING LIGHT HYDROCARBONS containing mercaptans.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 14, 1934. 449,783.

SUSPENSIONS FOR LUBRICATION and other purposes.—Sulflo Corporation of America. Aug. 15, 1934. 449,592.

THERMO-PLASTIC COMPOSITIONS and mouldings having a cellulose derivative basis.—British Celanese, Ltd. Aug. 14, 1934. 449,651.

Books Received

Flotation Plant Practice. By Philip Rabone. Second Edition. London: Mining Publications, Ltd. Pp. 166. 10s. 6d.

Blanchiment Teinture et Impression. By G. Martin. Paris: Librairie Armand Colin. Pp. 217. 10.50 fr.

F. B. I. Register of British Manufacturers, 1936-1937. Edited by Ernest A. Nash. Sixteenth annual edition. London: Federation of British Industries.

Corrosion Resistance of Metals and Alloys. By R. J. McKay and R. Worthington. New York: The Reinhold Publishing Corporation. London: Chapman and Hall. Pp. 492. 35s.

Chemical and Allied Stocks and Shares

IRON, steel and allied shares have remained the chief feature of interest in the industrial section of the Stock Exchange. In other directions rather dull conditions continued, although share values generally have been well maintained. Among shares of chemical and kindred companies B. Laporte were a good feature with a further advance, it being contended in some quarters of the market that as time proceeds there may be a further share bonus, although there has never been any official indication that this is contemplated. Imperial Chemical were again little changed, but were steady with few sellers reported as the shares are held firmly in view of the apparently good yield offered on the basis of last year's 8 per cent. dividend. British Oxygen were again active at higher prices, as were the ordinary shares of Murex which is another company believed to be benefiting from activity in the engineering and allied trades. There was a better tendency in Imperial Smelting in response to a firmer trend in the price of zinc. Greeff Chemicals Holdings 5s. shares were little changed at 9s. 3d. There was continued demand for shares of companies likely to benefit from the large scale plans of road construction. Tarmac and numerous other shares were more active in this connection, as were leading cement companies' shares, particularly Associated Portland Cement, which show a further good rise on balance for the week. Alpha, Tunnel, and Rugby Portland Cement were other cement shares to move in favour of holders. Paint shares also received more attention, on the belief that despite the possibility of a further upward trend in prices of materials used in the making of paint this is likely to be more than off-set by increased demand for paint as a result of the activity in shipbuilding and other industries. Lewis Berger and Pinchin Johnson were favoured, the former on anticipations of an increase in the final dividend and the latter on the possibility that some form of bonus may be in prospect, bearing in mind the statements at the last annual meeting. United Premier Oil and Cake and British Oil and Cake shares were active at higher prices in view of the upward movement in the prices of the products in which these companies are interested. There was a good deal of interest attaching to Triplex Safety Glass which have risen strongly on the view now current that rather than distribute a share bonus the directors may possibly make a large increase in the dividend. Estimates of the dividend in the market range up to 50 per cent. For the previous year 30 per cent. was paid, but this was a conservative payment. British Glues were firm on favourable views of prospects. Fison, Packard and Prentice were steadier, and Burt, Boulton and Haywood unchanged. United Molasses received attention on the announcement of the intention to repay further prior charges. Distillers were higher, it being more generally realised that although the dividend has again been limited to 20 per cent., actual earnings on the ordinary capital were fully 27 per cent. last year. Elsewhere British Industrial Plastics (the new name for the company formerly known as British Cyanides) were active, there being hopes in the market that the dividend for the year may be 9 per cent. or possibly 10 per cent. For the previous year 8 per cent. was paid. Lawes Chemical were again unchanged, but the price was not apparently tested by much business and the shares continue to be held steadily. Staveley Coal and Iron have not kept best prices, but the market is continuing to look for a favourable increase in the dividend. Dorman Long and Consett Iron were active at higher prices. Boots Pure Drug were steady. International Nickel moved closely with the conditions ruling in New York markets. On balance there has been some improvement in the price and the market is continuing to budget for an increase in the dividend for the past quarter, while it is being anticipated that profits have moved up further. The next quarterly statement will also give the total earnings for the first half of the year. Borax Consolidated deferred shares were in larger demand and have moved in favour of holders, aided by the encouraging views of dividend prospects which are current. Anglo-Iranian and other leading oil shares remained rather less active but on balance for the week have maintained their prices quite well.

Company News

Courtaulds, Ltd.—An interim dividend on the £24,000,000 ordinary capital of 2½ per cent., tax free, is to be paid on August 11 to shareholders on the books of the company at the close of business on July 8. A similar distribution was made at this time last year, and a final dividend of 5 per cent. was paid, making 7½ per cent. for the whole year. The transfer books of the ordinary shares were closed from July 9 to July 15.

Eastwoods Cement.—The report for the year to March 31 last shows that trading profits rose by £1,589, to £52,159, while net earnings at £36,777 compare with £34,888. The final dividend on the £200,000 capital is 11 per cent., less tax, making 16 per cent., against 15 per cent. Reserve receives £3,416, compared with £4,000, leaving the carry-forward (subject to directors' additional remuneration) higher at £10,381. Meeting River Plate House, E.C.2, July 22, at 12 noon.

Electrolytic Zinc Co. of Australasia.—Distribution on the ordinary shares for the year to June 30 last has been doubled with a final dividend of 6 per cent., making 10 per cent. In the previous year the holders of the £1,100,000 issued ordinary capital received 5 per cent., against 4 per cent. in 1933-34. A dividend for the half-year to June 30 last, also of 6 per cent., making 10 per cent., on the £1,500,000 8 per cent. cumulative participating preference shares is also announced. Both dividends are payable on September 10 to shareholders registered on July 30.

New Companies Registered

H. A. Broughton and Co., Ltd.—Registered July 11. Nominal capital, £500 in £1 shares. Manufacturers of and dealers in chemicals, gases, drugs, etc. Directors: Harry Broughton, 3 Glendale Avenue, Whitley Bay; and Harry A. Broughton.

Hulton Soap and Chemical Co., Ltd.—Registered July 14. Nominal capital, £3,000 in £1 shares. Soap boilers, manufacturers of and dealers in soap, washing, cleansing and bleaching powders, manufacturing chemists, etc. Directors:—Herbert S. Jones, 279 Wigan Road, Deane, Bolton, C. Munro, Dr. A. Owen, and J. J. Regan.

Napier Chemical Co., Ltd.—Registered July 10. Nominal capital, £500 in £1 shares. Manufacturers of and dealers in chemical gases, drugs, medicines, etc. Permanent governing directors:—Francis Nuttall, 12 South Bank Road, Bury; and John F. Ingle.

Silical Water Softeners (Industrial), Ltd.—Registered July 13. Nominal capital, £5,000 in £1 shares. To undertake the supply, softening, purification, aeration and storage of water for industrial purposes, etc. Directors: Ernest F. Bays, 27 Moor Lane, E.C.2, and Leonard Edge.

J. B. Thompson, Ltd., 101 Enfield Street, Belfast.—Registered in Belfast July 4. Nominal capital, £2,000 in £1 shares. Wholesale and retail chemists and druggists, etc. Subscribers: John B. Thompson and Arthur Thompson, 22 Onslow Parade, Belfast, accountant.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the South African Railways and Harbours Administration is calling for tenders (Contract No. 945) for the supply and delivery f.o.b. port of shipment of one coal pulverising unit complete with all equipment for firing two furnaces at the Bloemfontein Workshops. The system on which the unit will be required is 3 phase, 50 cycles, 220/380 volts A.C. Tenders endorsed "Tender No. 945 for Coal Pulverising Unit" should be addressed to the Chief Stores Superintendent, Park Station Chambers, Johannesburg, by whom they will be received up to noon on August 31, 1936. (Ref. T. 30,464.)

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the Chief Stores Superintendent, South African Railways and Harbours, is calling for tenders, to be presented in Johannesburg by August 17, 1936, for the supply of dry red and white lead. (Ref. T.Y. 40125.)

South Africa.—H.M. Trade Commissioner at Johannesburg reports that the South African Railways and Harbours Stores Department is calling for tenders (Contract No. 940) for the supply and delivery of two 20,000 gal. pressed steel tanks, 20 ft. by 20 ft. by 8 ft. deep, and one 42,000 gal. pressed steel tank, 32 ft. by 28 ft. by 8 ft. deep, complete with stands and fittings; one tank stand 32 ft. high, complete with latter. Tenders, endorsed "Tender No. 940 for Pressed Steel Tanks," should be addressed to The Chief Stores Superintendent, Park Station Chambers, Johannesburg, by whom they will be received up to noon on August 24, 1936. (Ref. T. 30,469.)

United States.—H.M. Consul at Detroit has furnished a list of fifteen agents in his district who desire to secure the representation of United Kingdom manufacturers of products for the chemical and paint industries. United Kingdom manufacturers, on application to the Department of Overseas Trade, 35 Old Queen Street, London, S.W.1, will be furnished with one or more names of appropriate agents selected from the list. (Ref. 23322/1936.)

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